Farnborough INTERNATIONAL AIRSHOW

19 - 25 July - 2010

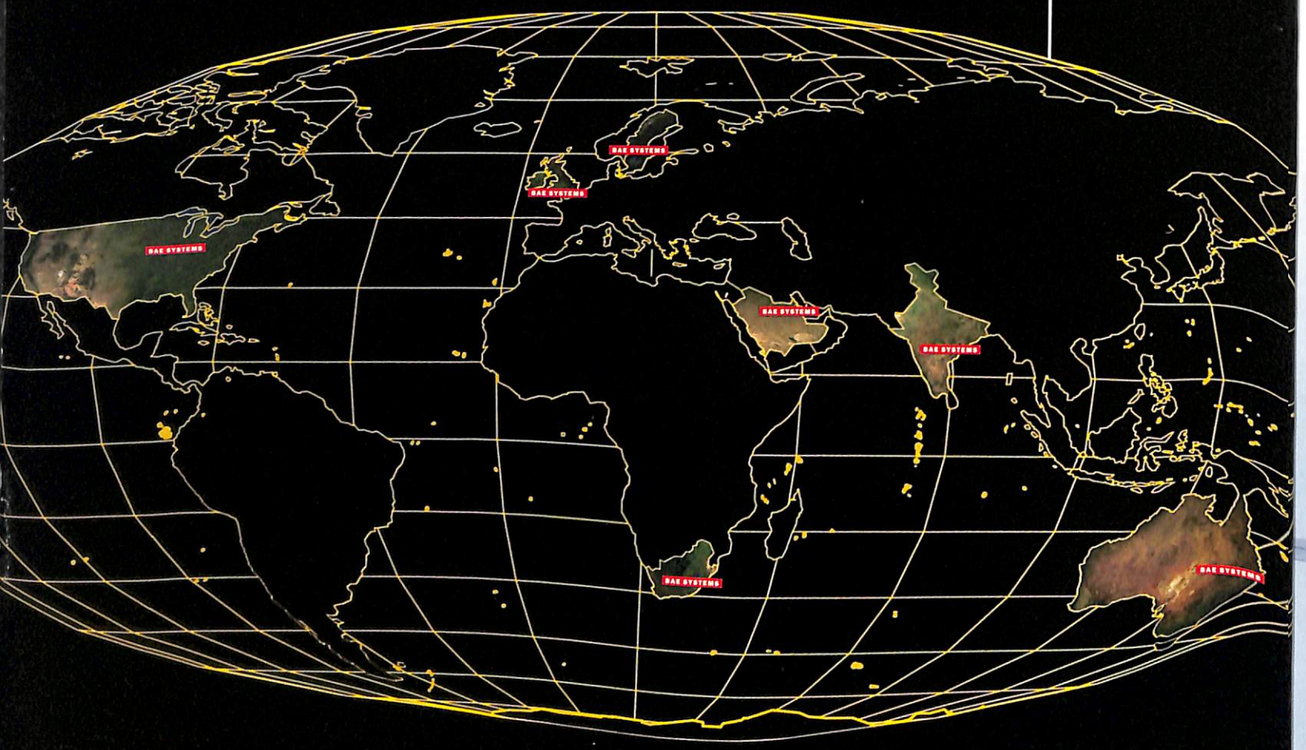
Published on behalf of Farnborough International Ltd by Key Publishing Ltd

£6

Farnborough INTERNATIONAL **2010 OFFICIAL SOUVENIR PROGRAMME** ADS AeroSpace | Defence | Security

THE HOME OF INNOVATION.

From radar to adaptive signature technology to ultra lightweight body armour, we have an unprecedented history of innovation firsts. However, we're always striving to better ourselves. We're continually developing new technologies, like IT and cyber security, unmanned autonomous systems and services to provide our armed forces with the support they need whenever and wherever they need it.



Visit us at:
FIVE
Farnborough International
VENUE+EVENTS

BAE SYSTEMS
REAL INNOVATION. REAL ADVANTAGE.

Aircraft old and new will be on show during the public days. KEY – GARY PARSONS

The Farnborough International Airshow programme 2010 was produced and published by Key Publishing Ltd, PO Box 100, Stamford, Lincs, PE9 1XQ. Tel 01780 755131, Fax 01780 757261, website www.keypublishing.com

Editor: Gary Parsons
Assistant Editor: Mark Nicholls
Design: Steve Donovan
Editorial Production: Sue Blunt and James Forsyth
Advertising Production: Ian Maxwell and Keri Thompson
Colour and Origination by: Key Publishing
Printed by: Headley Brothers Ltd.

Key Publishing's magazine portfolio includes: FlyPast, AirForces Monthly, Airliner World, Airports of the World, Air International, Today's Pilot, PC Pilot and Airports International. For more information visit www.key.aero

No part of this publication may be reproduced or stored in a retrieval system without the prior permission of the publisher.

Farnborough INTERNATIONAL ADS AeroSpace | Defence | Security KEY

4 Show Information
5 Site Map
6 Welcome to Farnborough by Captain Eric 'Winkle' Brown
8 Farnborough 2010 Themes
9 Aircraft Participants — Trade days
11 Aircraft Participants — Public days
28 Battle of Britain Memorial Flight
30 A 21st Century Farnborough
34 Sniffing for a Record — Bloodhound SSC
37 Diamond Da42NG Twin Star Flight Test
42 Boeing's Big Year
47 Mr Blue Sky! RAF King Air Solo Display
52 Lightning Shock — the F-35
58 Milestones
64 V-Bombers at Farnborough
66 JF-17 Thunder – From Dreams to Reality
71 Bristol Fashion — 100 Years of British Aerospace
78 From FIMA to A400M
84 Exhibitor listings
96 Exhibition Hall maps

Airbus Military's A400M will perform in the skies above Hampshire for the first time this week. KEY – GARY PARSONS

Useful Information

As well as the air display with running commentary, this fantastic day out for all the family includes:

Their Finest Hour - Commemorating the 70th Anniversary of the Battle of Britain, 'Their Finest Hour' brings to Farnborough a unique exhibition and display of memorabilia;

The Bloodhound supersonic car – the engineering adventure to break the world land speed record (see page 34 for more);

The Space Zone including the new Space Pavilion; An area dedicated to **Futures in Aerospace** featuring Build-A-Plane and Roaming Robots;

The Crafty Arty Party - From tots to teens, the party will offer a host of activities and entertainment, this year themed around Alice in Wonderland;

Team Extreme, the world class skateboard, BMX and inline skate display team showcasing their stunts and tricks;

A selection of **flight simulators** giving you the full flight experience in the cockpit of a Spitfire and Red Arrows Hawk;

Land Rover Experience Terrapod - Test your nerves and skill on the Terrapod, offering top 4x4 action with hill climbs, descents and other obstacles. Are you brave enough to try it?

FOOD AND DRINK

The showground offers a wide range of food and beverage facilities including a brasserie-style restaurant, Café bars and outdoor food courts.

The **Skyview Restaurant** located on the upper level of Hall 1A will serve brasserie-style lunches on Saturday and Sunday - pre-booking is strongly advisable as it is extremely popular. **Cafés and Bars** are located in Exhibition Halls 1A, 2, 3 and 4, serving a selection of hot and cold drinks and sandwiches and snacks throughout the day. **Outside Food Courts** are available throughout the weekend, offering a wide range of hot and cold food, drinks and snacks. See the site plan opposite for the location of the nearest one to you.

SECURITY INFORMATION

FIL wants everyone to enjoy a safe and secure airshow, but at the same time asks that spectators are aware of and fully co-operate with the following measures:

All visitors and items of baggage are liable to be searched as condition of entry to the Farnborough International Airshow; Visitors exiting the site will not be permitted re-entry; Smoking and the use of mobile phones is not permitted within 15 metres of any aircraft and through the static aircraft park.

EXITING THE SITE

In order to ensure your swift departure from the site and on your homeward journey, please make you exit by the correct gates.

Gate A - Taxi Rank

Gate B - Pedestrian exit and Shuttle buses to Train Stations, Queens Parade Car Park and London General Coach Service to London

Gate F - Car Park Exit and Shuttle buses to Eelmoor Road, Rushmoor Arena and Queens Parade* Car Parks. Shuttle bus to Claycart Coach Park

* Only a limited bus service will operate from Gate F to Queen's Parade Car Park.

LOST CHILDREN

If you find a lost child, please take them to the Lost Children's Centre (by Gate E) or find a member of the airshow staff who will escort them there.

Here they will be cared for by our team of experienced staff, and we will make every effort to contact the Parent/Guardian.

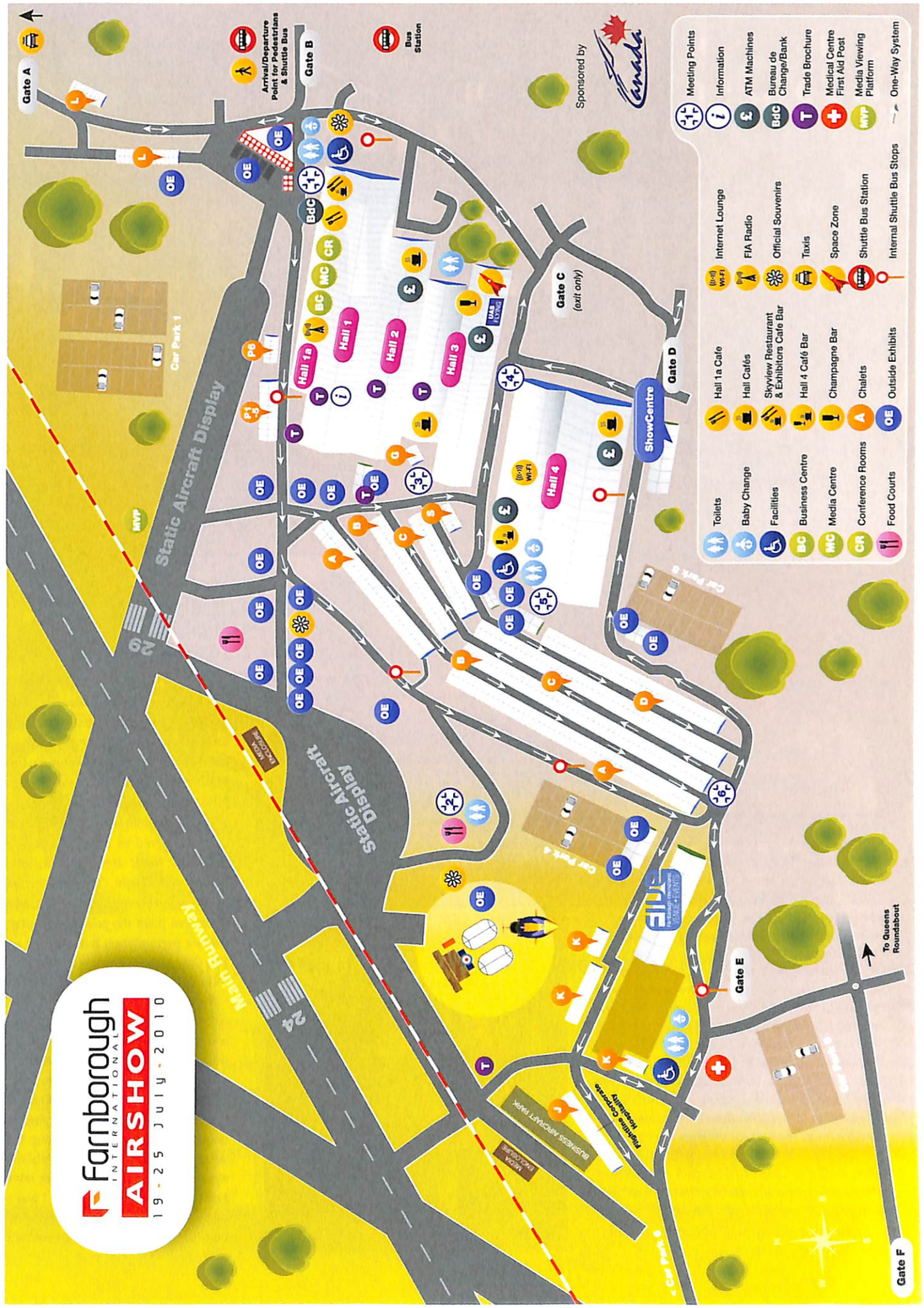
If you have become separated from your child, please report to the Lost Children's Centre.

TUNE IN TO FARNBOROUGH INTERNATIONAL FM!

Keep up to date with what's going on and find out the latest traffic information by tuning in to Farnborough International radio on 87.7FM.

Please note: Exhibitors and aircraft listed as participants in the Farnborough International Airshow 2010 are, at the time of going to print, intended and expected. It is always possible that such participation may not take place due to reasons beyond the control of the show organisers. Every effort has been made to ensure that the information within this Souvenir Programme is accurate and representative at the time of production. For publicity and marketing purposes the Organisers have photographers taking pictures of the activities, attractions and displays. These photographs may also feature visitors enjoying the event. By entering the site, visitors consent to being photographed. Our photographers have full authorisation from the Organisers and are happy to identify themselves by their official passes, on request.

The manner in which information contained in this magazine may be used is beyond our control and Key Publishing Ltd and Farnborough International Ltd cannot be held responsible for consequences arising from its use.



Welcome to Farnborough

Eric at Farnborough in 1945, standing on the runway undertaking flying control duties – how times have changed! Image courtesy Eric Brown

By Captain Eric M Brown, CBE, DSC, AFC, RN

The town of Farnborough in Hampshire is my spiritual home. Although I lived there for only six years, they were the most exciting of my life and projected me into the crucible of British aviation research when it was at its hottest.

I arrived as a young test pilot at the Royal Aircraft Establishment in January 1944, stepping into a dead man's shoes at short notice, and was immediately aware that I was in a pressure pot of frantic activity to keep Britain and its Allies in a position to counter Germany's advanced aviation technology of World War Two.

Events moved so rapidly in those days that I was the Chief Naval Test Pilot, CO of the prestigious Aerodynamics Flight, CO of the High Speed Flight, CO of the Captured Enemy Aircraft Flight, all within two years. Up to that point the priority was totally on enhancing military performance, but with the end of World War Two the emphasis changed to building an efficient and competitive civil aviation fleet for the post-war era.

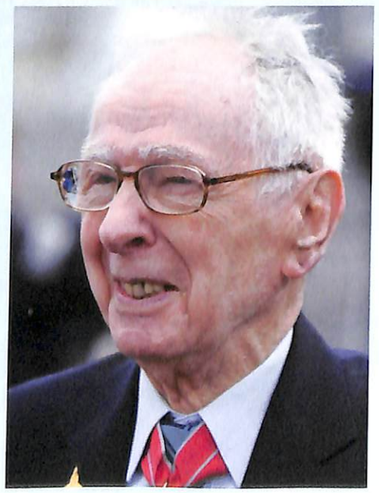
The transition from military to civil aviation coincided with the advent of the Jet Age and RAE Farnborough was the obvious place to display the UK's latest aviation wares to the world, and so in 1945 the first international airshow was planned at Farnborough.

The Society of British Aircraft Constructors welcomed this initiative, and from both commercial and political points of view this was the group that would ensure success for the Farnborough Airshow. The first such event took place in a somewhat relaxed atmosphere. I certainly was relaxed because I was acting as aircraft display despatcher, standing on the main runway near Cody's tree. It was a delightful event and has blossomed ever since.

AN EXTRAORDINARY TEST PILOT

A former Royal Navy officer, Eric is famous for flying more types of aircraft than anyone else in history, as well as being the Fleet Air Arm's most decorated pilot. Now turned 91 years old, Eric belies his age with an awareness and spirit of someone twenty years younger.

Born on January 21, 1919 in Leith near Edinburgh, Eric first flew when he was 18. With the sea in his blood he joined the Royal Navy Volunteer Reserve in 1939, before committing to the Fleet Air Arm as a pilot. During 1941 he was with 802 Squadron aboard HMS Audacity flying Martlets over the Mediterranean, during which time he downed two enemy Focke-Wulf Fw 200 'Condor' maritime patrol aircraft. Towards the end of the Second World War, Eric commanded the Enemy Aircraft Flight, flight-testing captured Luftwaffe aircraft, including the Messerschmitt 163 and 262. He then moved on to developing aircraft carrier landing techniques, including the first landing of a jet aircraft on December 3, 1945. He holds the world record for the most carrier landings at 2,407. He finally retired in 1992.



Right: ***Captain Eric Brown aboard HMS Illustrious in 2009.*** Key – Gary Parsons

The Rolls-Royce Science Prize. Getting your school's ideas off the ground.

Actively supporting the development of science education.

As well as powering the world's most advanced aircraft, we also help young people's ideas to fly. Over the past four years we have invested £560,000 in 226 schools to benefit 70,000 pupils through the Rolls-Royce Science Prize. Our website provides a database of over 1,000 science teaching ideas. If you are a teacher or parent and want us to help you fuel young imaginations far into the future, visit our website to find out more.

Trusted to deliver excellence

www.rolls-royce.com

Rolls-Royce

Fancy a chat?

Farnborough International 2010 has a themed conference programme for the first four days of the airshow, offering visitors and exhibitors greater focus to their visit.

Monday is Aerospace day; Tuesday – Defence; Wednesday – Space and Thursday – Security. Each conference will feature speakers from both government and industry.

Speaking about the Conference Programme, Ian Godden, Chairman of A|D|S, said "The conference programme will provide an excellent opportunity for visitors to the airshow to some of the major issues that are affecting their industry today."

Shaun Ormrod, Chief Executive at FIL added: "The conference programme is an important first for the Farnborough International Airshow and part of our initiative to improve the visitor experience at the event."

Farnborough's Futures Day

INSPIRING YOUNG MINDS TOWARDS A CAREER IN AEROSPACE & DEFENCE

FUTURES DAY 23 JULY '10

Aimed at children between the ages of 7 and 17, 'Futures Day' on Friday is aimed to get children to be part of the solution to global challenges such as climate change and stimulate interest through various activities including lectures, demonstrations, hands-on activities, a treasure hunt and a careers fair with opportunities to meet both key people from the sector and young people already embarking on careers in the sector.

On the day you'll have the opportunity to:

- Meet future astronauts;
- Meet both industry leaders and young people starting a career in the sector;
- Attend a series of short lectures (no more than 20 minutes each);
- See the Schools Build a Plane Challenge;
- View the Tri-national Rocketry Finalists;
- See the Bloodhound supersonic car and Mars rover;
- Get excited about science, technology, engineering and mathematics (STEM);
- See what the aerospace & defence sectors have to offer;
- Get careers advice.

UAS displays get green light

Unmanned Aerial Systems (UAS) will be on display in the Association for Unmanned Vehicle Systems International (AUVSI) pavilion and also flying prior to the main flying display. KEY COLLECTION

In yet another first for Farnborough, the organisers have secured an agreement, in principle, from the Civil Aviation Authority and Airport authorities to allow Unmanned Aircraft Systems (UAS) to be demonstrated as a regular part of the display programme.

Taking into account all the necessary regulations and risk assessment, a dedicated 30-minute UAS display will take place prior to the start of the flying display. Rod Dean, Director of Flight Operations said: "We have undergone a great deal of discussion to secure an agreement in principle with the CAA and now have a set of guidelines that will allow UAS manufacturers to demonstrate their aircraft. We expect a good number of customers to take up this opportunity."

Visit the Association for Unmanned Vehicle Systems International (AUVSI) pavilion located across from the UAV demonstration area and the interactive Space Zone.

Airshow Participants

TRADE DAYS ONLY!

ABOVE: ***Although only appearing in the static park on Monday and Tuesday, Boeing's 787 Dreamliner is set to make its international debut this week at Farnborough, underlining the event's status as a world leader. The first aircraft, ZA001, is expected to perform a short display on Tuesday before it heads back to the US.*** BOEING IMAGE

RIGHT: ***Returning for a second visit, the US Air Force Air Combat Command's Lockheed Martin F-22 Raptor Demonstration Team will be flying on Monday and Tuesday. Based at Langley Air Force Base in Virginia, the pilot is Major Dave 'Zeke' Skalicky, a former F-15C flyer and now an instructor on the USAF's latest and most potent aeroplane.*** KEY COLLECTION

FLYING DISPLAY TIMES - TRADE DAYS

Monday 1330 to 1600 hrs
Tuesday to Thursday 1415 to 1645 hrs

ABOVE: **Airbus Military's A400M** ***transporter was the undoubted star of ILA 2010, Berlin's international airshow held at Schönefeld Airport to the south of the city in early June. At the controls was Chief Test Pilot Ed Strongman, who put the giant aircraft through a surprisingly spritely routine, given the early stages of the test programme, achieving an angle of bank of an amazing 120 degrees. MSN 001, the first prototype, carries 17 tonnes of test equipment but it didn't stop a full aerial demonstration being given, including a short-field landing with plenty of tyre smoke. It is set to be the star of the trade days at Farnborough, appearing on Monday through to Thursday.*** KEY - GARY PARSONS

RIGHT: *The* **RAF Eurofighter Typhoon** *display pilot for 2010 is Flt Lt Tim Clement from 29(R) Squadron at RAF Coningsby in Lincolnshire. A former Jaguar pilot, Tim is now an instructor with the squadron and will be displaying the Typhoon on Monday through Wednesday. A Typhoon from BAE Systems is also scheduled to take part in the flying displays at the weekend.* KEY COLLECTION

BELOW: *Displaying from Monday through to Thursday will be Flt Lt Bill Ramsey in the* **Grob Tutor** *from 115(R) Squadron, RAF Cranwell. Used to train students in elementary flying, the Tutor has been in service for eleven years.* COURTESY GEOFF LEE

A **Sentinel R1** *from V(AC) Squadron, RAF Waddington is scheduled to perform a flypast on Monday through to Thursday. The aircraft's ASTOR (Airborne Stand-Off Radar) provides a long-range, battlefield-intelligence, target-imaging and tracking radar for the RAF and the Army.* KEY COLLECTION

The **Sukhoi Superjet's** *first order came in August 2005 during the Russian MAKS air show with the Finance Leasing Company signing a contract for ten aircraft. A type certificate should be awarded in late 2010, with deliveries to launch customers Aeroflot and Armenia's Armavia following by the end of the year. Here three Sukhoi prototypes hold formation, Sukhoi Su-35 Flankers 901 and 902 linking up with Superjet 100 RA-97001 during a test flight from Komsomolsk-on-Amur in April 2009. It is due to fly on Monday, Tuesday and Wednesday this week.* SUKHOI IMAGE

Public Days Performers

ABOVE: *The RAF operates the largest fleet of* **Boeing Chinook** *Support Helicopters after the US Army, with a total of 34 HC2s, six HC2As and eight new HC3s. The crew consists of either two pilots, or a pilot and a weapon systems officer (WSO), and two air loadmasters who are responsible for passenger safety, load or cargo restraint, weapons operation and voice marshalling of the aircraft. This year's display crews are drawn from personnel of 18(B) and 27 Squadrons based at RAF Odiham in Hampshire.* CROWN COPYRIGHT/MOD

LEFT: *Flt Lt Tom 'Cinders' Saunders from 208(R) Squadron, RAF Valley, provides the* **RAF BAe Hawk T1** *display this year. An instructor on the squadron, Tom got into the air force at his second attempt at the ripe age of 24. "I think recruiters want to see some motivation; they want to see that you're dedicated to the service and not just the flying," he explained.* CROWN COPYRIGHT/MOD

BELOW: *Embarking on his third season as display pilot on the* **RAF Hawker Beechcraft King Air** *is Flt Lt Leon Creese, from 45(R) Squadron, RAF Cranwell. See our full-length feature from Leon on page 43.* IMAGE COURTESY LEON CREESE

FLYING DISPLAY TIMES - PUBLIC DAYS

Friday 1330 to 1700 hrs
Saturday & Sunday 1230 to 1730 hrs

Above: *The British Army's Parachute Regiment Freefall Team, 'The Red Devils', supports recruitment through carrying out over 100 displays each year. The team is manned by 20 serving soldiers from the Parachute Regiment's three full-time battalions: 1, 2 & 3 PARA. Every member of the team has served a minimum of three years in a Parachute Regiment battalion and has taken part in at least one operational tour of duty in either the Falkland Islands, Northern Ireland, Kosovo, Sierra Leone, Afghanistan and/or Iraq.* Key - Gary Parsons

Above: *Flight Lieutenant Tom Bould is this year's* RAF Short Tucano *display pilot and an instructor with 72(R) Squadron at RAF Linton-on-Ouse in North Yorkshire, which provides basic training for future fast jet pilots. Tom's two display aircraft have received 'Spitfire camouflage' paint schemes to commemorate the 70th anniversary of the Battle of Britain.* Courtesy Geoff Lee

Right: *It's been an unusual build-up to the new season for the Royal Air Force's Aerobatic Team, the* Red Arrows. *There's been unmatched national media interest due to two significant factors – after 45 years the team welcomed its first-ever female pilot, Flight Lieutenant Kirsty Moore, and in March an incident left Red 6, Flt Lt Mike Ling, out for the season after ejecting from his aircraft. Taking over the Red 6 seat at short notice is Flt Lt Paul 'Pablo' O'Grady, who was the 2008 Synchro Leader and was flying the Typhoon earlier this year.* Crown copyright/ MoD

DA42 MPP (Multi Purpose Platform) GUARDIAN

Now also active in air monitoring

Precision from Above

Jet Fuel capability | 13.5 hrs endurance | 1,200 nm range

All weather capability at day and night

Monitoring of air emissions | Border control | Harbour and coastal surveillance

Monitoring of critical infrastructure | Fire fighting | Flood prevention | Riot screening

Geo hazard management | Law enforcement

www.diamond-sensing.com

Visit us at the Farnborough Airshow:

19th - 25th July, 2010 | OE18

Diamond AIRCRAFT

FAR MORE TO COME

9-15 JULY

2012

www.farnborough.com

Farnborough INTERNATIONAL AIRSHOW

ABOVE: *BAE Systems will be displaying a development* **Eurofighter Typhoon** *on all seven days of the airshow and will most likely present the aircraft in full weapons fit as seen at Farnborough in 2006.* EUROFIGHTER IMAGE

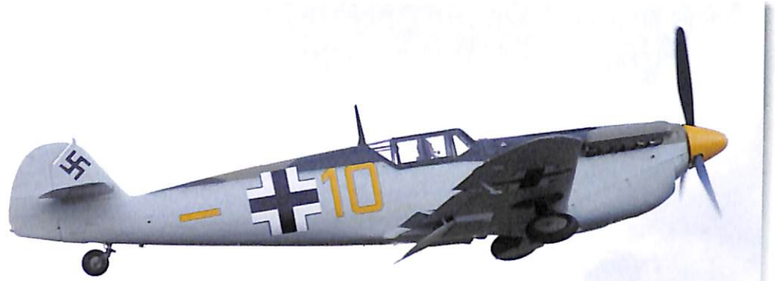
ABOVE: *The US Air Force Global Strike Command's* **Boeing B-52H Stratofortress** *is a long-range, heavy bomber that can perform a variety of missions first used in the 1960s. It is capable of flying at high subsonic speeds at altitudes up to 50,000ft (15,200m) and can carry nuclear or precision-guided conventional ordnance. It is expected to remain in service for another 30 years! The aircraft flying this week on Wednesday, Thursday, Saturday and Sunday is from the 5th Bomb Wing based at Minot Air Force Base in North Dakota.* USAF

RIGHT: *The* **Lockheed Martin F-16C Fighting Falcon** *is a compact, multi-role fighter aircraft, highly manoeuvrable and has proven itself in air-to-air combat and air-to-surface attack in many air forces around the world with over 4,500 built to date. This week's aircraft will be drawn from the 52nd Fighter Wing based at Spangdahlem Air Base in Germany.* USAF

Above: *Boeing will be flying its* **F/A-18E Super Hornet** *on all seven show days, using test pilots Mike Wallace and Steve Schmidt. In service with the US Navy since 1999, it is seen as a potential low-cost alternative to the Joint Strike Fighter by many European nations.* Key collection

Left: *The 'Knights of the Sky' of the Great War (1914-18) are recreated by the Great War Display Team. In an exhilarating display of up to 15 minutes, you will see the sky filled with up to ten aircraft as Allied aircraft tussle with their German counterparts for control of the air. Bombs are dropped and aircraft are shot down, departing the scene trailing smoke.* Key - Gary Parsons

Below: *In 1916 Bristol designed a large, rugged and ultimately unsuccessful two-seater called the F.2a. An improved version, the Bristol Fighter F.2b, entered service in March 1917 and pilots soon learnt that the 'Brisfit' could be thrown around the sky. It remained in production until 1926 and was used by the RAF in peacetime as an army co-operation aircraft and also by University Air Squadrons as a training aircraft. Shuttleworth Collection's D8096 was built in 1918 and flown by 208 Squadron in Turkey in 1923 – the collection acquired the aeroplane in 1952 and it is one of just three airworthy Bristol Fighters in the world.* Key collection



Left: *The Royal Navy's Helicopter Display Team,* **The Black Cats,** *flies Lynx helicopters out of its base at RNAS Yeovilton in Somerset. For 2010 the team is led by Lt Becky Frater (Black Lead) with Lt Chris Chambers as Black 2.* Key - Gary Parsons

Below: *The* **Army Historic Aircraft Flight** *(AHAF) was formed in December 1977. Its aim is to maintain out-of-service Army fixed and rotary wing aircraft in flying condition for publicity, posterity, the promotion of 'esprit de corps' and recruiting purposes. Fixed-wing aircraft include an Auster AOP Mk9, Beaver AL Mk1 and Chipmunk T10; helicopters include a Skeeter AOP Mk12, Sioux AH1, Alouette II and Scout AH1.* Key collection

Left: *A* **Hispano Aviación HA-1112 Buchón** *is a Rolls-Royce Merlin-engined Messerschmitt Bf 109 manufactured in Spain. The aircraft flying in the display is Spitfire Ltd's G-BWUE, built in 1959 and one of 27 purchased from the Spanish Air Force to appear in the 1968 film Battle of Britain – it has recently been restored to the markings it wore in the motion picture to celebrate the 70th anniversary of the Battle.* Image courtesy Bob Franklin

Below: **Spitfires** *will include two aircraft from the Aeroplane Restoration Company based at Duxford Airfield in Cambridgeshire. Rolls-Royce's Mk XIX PS853/G-RRGN, a late photo-reconnaissance machine, is a regular sight at Farnborough airshows.* Key collection

Perfect.

Inspiring Views . Unique Location . Exclusive Hospitality
Luxurious Accommodation . Fabulous Food

Brasserie open for dinner and Deli open for light meals and afternoon tea during the Airshow.
For details of hospitality packages and unique viewing opportunities at Aviator contact our Airshow Reservations Team on 01252 555893 or email reservations@aviatorfarnborough.co.uk

AVIATOR
FARNBOROUGH

55 Farnborough Road, Farnborough, Hampshire GU14 6EL, UK
T. +44 (0)1252 555890 F. +44 (0)1252 555899 E. airshow2010@aviatorfarnborough.co.uk www.aviatorfarnborough.co.uk

ABOVE: *With 49 combat sorties, five enemy aircraft destroyed, and being itself shot down in the Battle of Britain,* **Hawker Hurricane** *R4118/G-HUPW is regarded as one of the most historic British aircraft to survive in flying condition from the Second World War. Today it is owned by Peter Vacher.* KEY - GARY PARSONS

ABOVE: *ATR will be demonstrating its latest* **ATR 72-600**, *which offers an increased payload and operational range compared to previous models. Fitted with the Pratt & Whitney 127M engine, the ATR 72-600 can carry up to 70 passengers over a 300nm (550km) distance and has a 6° steep slope approach capability, allowing operations into airports with difficult access.* ATR

RIGHT: *The* **Alenia Aermacchi M-346 Master** *is a military transonic trainer aircraft, developed as a joint venture between the company and Russian firm Yakovlev. The Italian Air Force has placed an initial order for six aircraft to be delivered before the end of the year.* KEY COLLECTION

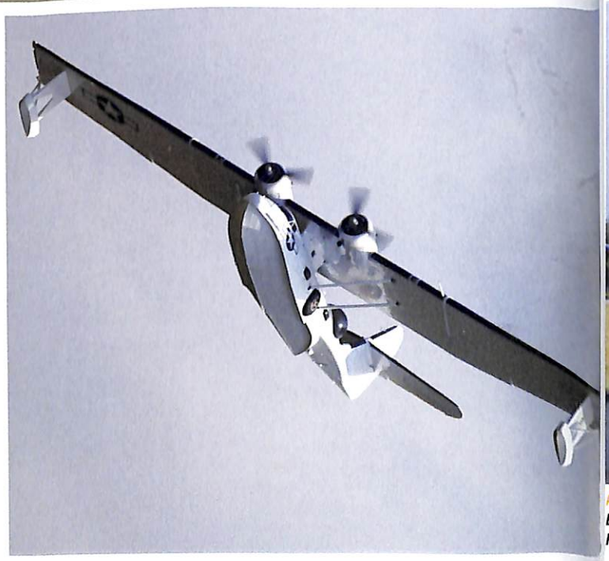
ABOVE: *In service with the Italian Air Force, the* **Alenia C-27J** *was selected as the winner of the US Department of Defense's Joint Cargo Aircraft (JCA) in 2007 and is now entering service with the US Air Force. The US version has been developed by a consortium led by Finmeccanica's Alenia North America, L-3 Communications Integrated Systems and Global Military Aircraft Systems.* KEY - GARY PARSONS

RIGHT: *The* **Lockheed Martin C-130J Super Hercules** *has been designed and developed with mission flexibility in mind – it undertakes combat delivery, air-to-air refuelling, special operations, disaster relief and humanitarian missions. In service with many air forces around the world, latest customers include Norway, Canada, and soon India.* USAF

BELOW: *Viking Air announced the production re-launch of a modernised* **de Havilland Canada Twin Otter** *in March 2007 with the introduction of the DHC-6 Series 400 model, which features over 400 modifications and improvements centred on a completely modernised flight deck, new avionics and engines.* VIKING AIR

RIGHT: *Plane Sailing's* **Consolidated Catalina** *G-PBYA began its life as a Royal Canadian Air Force Canso A (serial 11005). After the end of the war several mapping organisations used the aircraft before it became a water-bomber in France. Plane Sailing acquired G-PBYA in August 2002 and operates it as a consortium, enabling 20 shareholders to own a piece of aviation history.* KEY COLLECTION

BELOW: *Celebrating the aircraft's 50th birthday, it is hoped that the Vulcan to the Sky Trust and the Vulcan Operating Company will have completed essential servicing in time for* **Avro Vulcan B2** *XH558 to grace the sky over Farnborough for a second time in the 21st Century. All being well, XH558 will fly on Wednesday, Friday, Saturday and Sunday.* KEY COLLECTION



ABOVE: *The Royal Navy Historic Flight will be bringing its Sea Hawk and Sea Fury. The Sea Hawk (pictured) wears the colours of 806 Naval Air Squadron and is the only airworthy example of its type in the world.* KEY - MARK AYTON

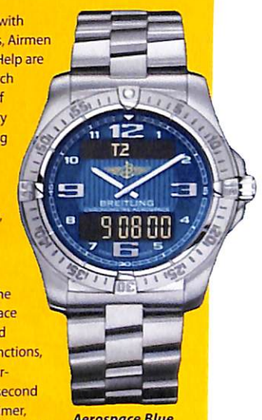
BELOW: *Now in their fifth consecutive display season,* **The Blades** *have teamed up with The Royal Air Forces Association for 2010. Blade 1 for 2010 is Myles Garland – a former RAF Harrier pilot and Red Arrows 'synchro lead', this is Myles' second season as the Team Leader following three seasons as a wingman and solo pilot. Chris Carder, Andy Offer and Dave Slow share the Blade 2 slot, while Blade 3 is Andy Evans, and Blade 4 (solo pilot) is Mark 'Cutty' Cutmore. The Blades operate the Extra 300 LPS and take it to the edge of its performance envelope, often reaching up to +10g during the more aggressive manoeuvres.* BLADES IMAGE

ABOVE: *Supermarine Seafire F Mk XVII SX336/G-KASX is owned by Kennet Aviation and based at North Weald in Essex. It flew after a lengthy restoration on May 3, 2006 and can often be seen with the Royal Navy Historic Flight's Sea Hawk and Sea Fury.* KEY - GARY PARSONS

BREITLING
1884

ONE BREITLING 'AEROSPACE' WATCH TO BE WON EVERY DAY!

Breitling, in association with SSAFA (Soldiers, Sailors, Airmen and their Families) Forces Help are offering an 'Aerospace' Watch in a prize draw every day of the airshow. The exemplary functionality of the Breitling Aerospace Watch (RRP £2,740) has made it a firm favourite among pilots. With a titanium case, a material widely used in cutting-edge aviation, this metal is renowned for its extreme lightness. But the real strength of the Aerospace lies in the careful choice and organisation of its many functions, and particularly in their user-friendly logic. 1/100th of a second chronograph, countdown timer, second time zone, alarm and audible time indication are all controlled by the crown, which need only be rotated, pressed or pulled out to perform all the desired operations. In terms of readability, Aerospace is not only equipped with oversized hands, but also features a particularly effective system of NVG-compatible display backlighting.



Aerospace Blue Dial Watch. BREITLING IMAGE

Enter the prize draw for just £5 per ticket, available from the Breitling Champagne Bar in Hall 3, the SSAFA stand (Hall 2 C5) and at Official Trade Catalogue and Souvenir Programme sales kiosks around the showground. From Monday to Friday the daily draw will take place at 17:00 in the Breitling Champagne Bar in Hall 3. Saturday's draw will be made on Sunday morning and Sunday's at an event the following Wednesday evening. Results will be published on www.farnborough.com

SSAFA125
FIRST IN » LAST OUT

SSAFA (Soldiers, Sailors, Airmen and their Families) Forces Help is the national charity committed to helping and supporting those who serve in the British Armed Forces, those who used to serve, and the families of both. Each year it provides a reliable, caring and trusted service to more than 50,000 people through a network of professionally trained staff and volunteers. It celebrates its 125th anniversary this year: www.ssafa125.org.uk

Registered Charity No. 210760 Est. 1885
Registered Charity (Scotland) No. SC038056

Static highlights

ABOVE: *Seven years after completing its first flight in China, the JF-17 Thunder is set to make its international debut this week. Pakistan Aeronautical Complex will be marketing the aircraft which is jointly developed with the Chinese Chengdu Aircraft Corporation. The aircraft has been going through test and evaluation since the Pakistan Air Force received its first two examples in early 2007 and the first operational unit, 26 Squadron, stood up at Kamra-Minhas this February.* KEY - ALAN WARNES

LEFT: *The* Bell 429 *is a light, twin-engine helicopter currently under development. It first flew on February 27, 2007 and received type certification on July 1, 2009. Intended specifically for the emergent medical services industry, it features a bigger cabin than its predecessor, the Bell 427. Launch customer is Air Methods Corporation, the largest medevac provider in the US.* KEY - GARY PARSONS

A familiar sight in the UK, the Boeing F-15E Strike Eagle *is still being manufactured and sold to international customers. The example on show will be from the 48th Fighter Wing based at RAF Lakenheath in Suffolk.* USAF

SSAFA125
FIRST IN » LAST OUT

SSAFA FORCES HELP

THE OFFICIAL CHARITY OF FARNBOROUGH INTERNATIONAL AIRSHOW 2010

For 125 years, The Soldiers, Sailors, Airmen and Families Association (SSAFA) – Forces Help has made an unfailing commitment to the men and women of Britain's Armed Forces and their families. We believe that bravery, dedication and commitment deserve a lifetime of support.

To find out about our celebratory year, or to donate to support our Armed Forces and their families, please visit:
www.ssafa125.org.uk

Tel: 020 7463 9373
Email: ssafa125@ssafa.org.uk

Registered Charity No. 210760 Est. 1885, Registered Charity (Scotland) No. SC038056

ABOVE: *The all-weather* **Northrop Grumman E-2 Hawkeye** *airborne early warning and battle management aircraft (AEW&BM) has served as the 'eyes' of the US Navy fleet for more than 30 years. Continuous modifications and upgrades have kept the aircraft's mission systems current and the E-2C Hawkeye 2000 possesses the most advanced AEW&BM capabilities in service today. A new version, the E-2D Advanced Hawkeye, is under development for the US Navy.* NORTHROP GRUMMAN CORPORATION

RIGHT: **Boeing's 777** *has been in service since 1995 with nearly 900 now operating around the world. A freighter version is also being produced, the first having been delivered to Air France on February 19, 2009.* KEY COLLECTION

BELOW: *Airbus's latest freighter, the* **A330-200F,** *made its first flight from the company's factory at Toulouse, France, on November 6, 2009. The manufacturer has 67 firm orders with nine customers, the first of which will be Etihad Crystal Cargo this summer. Airbus predicts the need for over 3,400 freighters in the next 20 years, 1,600 of which will be mid-sized such as the A330.* AIRBUS

ABOVE: *The* **Boeing C-17 Globemaster III** *is capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in the deployment area. It can perform tactical airlift and airdrop missions and can also undertake aeromedical evacuations when required. It is now achieving international sales success with customers including Australia, Canada, Qatar and the UK.* USAF

RIGHT: *Boeing's 737 series is one of the most popular jet airliners in the world and is the basis for the* **Boeing 737 AEW&C** *with its Multi-role Electronically Scanned Array (MESA) radar. The steerable beam, L-band electronically scanned array is able to track airborne and maritime targets simultaneously and can direct fighter aircraft while continuously scanning the operational area. Aircraft have been sold to Australia, Turkey and Korea.* BOEING IMAGE

BELOW: *Originally designated the An-148-200, the* **Antonov An-158** *is a stretched version of the company's earlier product and only flew for the first time on April 28.* ANTONOV IMAGE

Your airshow commentator

Stratton Richey.
KEY – GARY PARSONS

Stratton Richey is a Boeing 747 Captain with British Airways and Chairman of the charity 'High Flight' who has been commentating at Farnborough since 1976. He took the 'hot seat' as Chief Commentator in 1996 and bought Mark Brown onto the team as his number two. The team start work for the airshow, aided as usual by Janes' 'All the World's Aircraft', two months before, and update with the exhibitors in the final days before the show starts. We asked Stratton for his lasting memories of Farnborough past; "The colours and sounds of a late evening from the balcony of a chalet, watching the Battle of Britain Memorial Flight carrying out their validation flight, with the sun setting over Laffan's Plain and a hot air balloon in the distance."

Making its third Farnborough appearance, the **Airbus A380** *will again dominate the flying displays all week.*
KEY COLLECTION

AIRCRAFT PARTICIPATION LIST

Operator	Aircraft	Flying/Static
2Excel Aviation - The Blades	Extra 300 x 4	F
Action Aviation	Dornier 328 VIP	S
Action Aviation	Sino Swearingen SJ30	S
Advanced UAV Technology	Static UAV	S
AgustaWestland	AW101	S*
AgustaWestland	AW109 LUH	S*
AgustaWestland	AW119A	S*
AgustaWestland	AW139	S*
AgustaWestland	AW159	S*
AgustaWestland	Grand New	S*
Air Cadets	Vigilant & Viking gliders	S
Air Tractor	AT802	S
Airborne Technologies GmbH	Tecnam MMA	S
Airbus	A330F	S*
Airbus	A380	F & S
Airbus Military	A400M	F & S*
Airbus Military	C295	S
Aircraft Restoration Co.	HA-1112 Buchón	F & S^
Aircraft Restoration Co.	Spitfire	F & S^
AJ Walter Aviation	Challenger 604	S*
Alenia Aermacchi	M346	F & S
Alenia Aeronautica	ATR 42	S
Alenia Aeronautica	C-27J	F & S
Alenia Aeronautica	Eurofighter	S
Antonov	An-158	F & S*
Army Air Corps - Army Historic Flight	Auster, Beaver, Chipmunk, Skeeter, Sioux, Alouette & Scout	F & S^
ATR	ATR 72-600	S
BAE Systems	Hawk T2	S
BAE Systems	Typhoon	F
Bell	Bell 407	S*
Bell	Bell 429	S*
Boeing	737 AEW&C	S
Boeing	787-8	F & S*
Boeing	F/A-18F Super Hornet	F & S
Boeing	Phantom Ray UAV replica	S
Bombardier	Challenger 605	S*
Bombardier	CRJ900	S*
Bombardier	Global 500	S*
Bombardier	Learjet 60XR	S*
Bombardier	Q400	S*
British Airways	Airbus A318	S^
British Airways	Embraer 190	S
British Disabled Association	PA28	S
Britten Norman	Islander x 3	S
CATIC	JF-17 Thunder x 2	S
Cessna	182	S*
Cessna	Citation Mustang	S*
Cessna	CJ3	S*
Cessna	Grand Caravan	S*
Cessna	XLS	S*
Cirrus UK	Aquila A210	S*
Cirrus UK	Cirrus SF50 replica	S*
Cirrus UK	Cirrus SR22	S*
Cirrus UK	Vulcanair P68R	S*
Cranfield University	Jetstream 31	S*
Dassault	Falcon 2000Lx	S*
Dassault	Falcon 7X	S*
Dave Sykes	Microlight	S^
Diamond	DA42 x 2	S*
Diamond	King Air 200	S*
Dynamic Aviation	King Air 90	S
EADS	DA42NG Biofuel	S
FLIR Systems Ltd	Pilatus PC-12	S*
Great War Display Team	WWI replicas	F
Hawker Beechcraft	AT-6	S*
Hawker Beechcraft	Hawker 4000	S*
Hawker Beechcraft	King Air 300 & 350i	S*
Hawker Beechcraft	King Air C390GT	S*
Hawker Beechcraft	T-6 Texan	S*
Lasham Gliding Club	Glider	S^
Lockheed Martin	C-130J Hercules	F & S
Lockheed Martin	F-16C Falcon x 2	F & S
Lockheed Martin	Gulfstream GIII	S
Mark Jeffries	Extra 330SC	F^
Peter Vacher	Hurricane Mk I	F^
Pilatus	PC-12	S*
Pilatus	PC-21	S*
Pilatus	PC-6	S*
Plane Sailing	Catalina	F^
Qatar Airways	Boeing 777	S*
Qatar Airways	Challenger 605	S*
Royal Air Force	Chinook HC2	F & S^
Royal Air Force	Hawk T1	F^
Royal Air Force	King Air B200	F
Royal Air Force	Sentinel R1	F*
Royal Air Force	Typhoon FGR4	F*
Royal Air Force BBMF	Lancaster, Spitfire & Hurricane	F^
Royal Air Force Red Arrows	Hawk T1 x 9	F
Royal Navy Historic Flight	Seafire	F^
Royal Navy Historic Flight	Sea Hawk	F^
RVL Aviation	Cessna 406	S
Saab	JAS-39 Gripen	S
Selex Galileo UK	Cessna 406	S
Sukhoi	Superjet 100	F & S*
Thales	Sea King	S*
Triple S Aviation	Grumman G-21 Super Goose	S
US Department of Defense (DoD)	F-22A Raptor	F*
US DoD	AH-1Z Viper	S
US DoD	B-52H Stratofortress	F
US DoD	C-17A Globemaster III	S
US DoD	E-2C Hawkeye	S
US DoD	F-15E Strike Eagle	S
US DoD	MH-60S Sea Hawk	S
US DoD	UH-1Y Venom	S
UTSL	MSAT-500	S
UTSL	Vigilant UAV	S
Viking Air	Twin Otter 400	F & S
Viking Air	Boeing 737-500	S
Vulcan To The Sky Trust	Avro Vulcan	F & S

* - Trade days only ^ - Public days only

FLYING TIGERS
CALL US ON 01706 522112
www.flying-tigers.co.uk
BRITAIN'S DIE-CAST AVIATION SPECIALISTS
THE 'STAR' OF RIAT 2010
1/72nd SCALE
LAST FEW AVAILABLE!
HA2801 LOCKHEED F-22 'RAPTOR'
LANGLEY AIR FORCE BASE
FLYING TIGERS PRICE £44.99
BATTLE OF BRITAIN 70 YEARS
1/48th SCALE
LIMITED EDITION
HA7802 LATEST SPITFIRE Mk.1 RAF 92 Sqn.
Flt. Lt. ROBERT STANFORD TUCK, MAY 1940
DUE OCTOBER - PRE ORDER PRICE £38.99
RING US NOW FOR A FREE COPY OF OUR LATEST
SALE AND SPECIAL OFFERS LIST!
01706 522112

The BATTLE of BRITAIN
AIR SHOW
DUXFORD
4 AND 5 SEPTEMBER
Spitfires galore, The Red Arrows and much more. A great day out at the famous Battle of Britain airfield
Kids Go Free*
Gates open 8am. Flying starts at around 2pm.
*Terms & conditions apply.
All flying subject to weather, serviceability and operational commitments.
To book early and save visit
www.iwm.org.uk/battleofbritain
or call 01223 499 353. Junction 10, M11
ROYAL AIR FORCE Battle of Britain 70th Anniversary
IMPERIAL WAR MUSEUM

RIGHT: ***The BBMF's Dakota is both a training platform for the Lancaster and a display aircraft in its own right.*** KEY – GARY PARSONS

FROM FAR LEFT: ***BBMF fighter 'stack', top to bottom: Spitfire PR.XIX PS915, Mk.IX MK356, Mk.II P7350, Mk.V AB910 and Hurricane II LF363. The Flight also flies Hurricane II PZ865, Spitfire PR.XIX PM631 and is restoring to flying condition Spitfire XVI TE311.*** IMAGE COURTESY BBMF

Lancaster PA474 represents the 55,000 aircrew of Bomber Command that lost their lives in the Second World War. IMAGE COURTESY BBMF

Sqn Ldr Al Pinner handing over to Ian (right) on November 5, 2009. IMAGE COURTESY BBMF

Ready to Remember

As the Battle Britain Memorial Flight celebrates the 70th anniversary of the epic struggle of 1940, FlyPast talks to the new CO, Sqn Ldr Ian Smith

"My aspiration was t
fly a Spitfire or a Hurricane.

The Flight's 'Baby' Spitfire II P7350 in its newly acquired 603 (City of Edinburgh) Squadron colours as flown by Flt Lt Geoffrey Wellum when he shot down a He 111 in September 1940. Behind is Hurricane LF363. CROWN COPYRIGHT/MOD

Ian spent the winter planning what would be a hectic and demanding season. Naturally, the 70th anniversary of the Battle of Britain is at the fore this year, as Ian explains in current jargon: "RAF engagement strategy is 70th-centric." This does not mean that all else has been dismissed - far from it, the BBMF has for decades proved itself to be masters of "the art of the possible."

Ian: "We endeavour to achieve all that we can, bearing in mind that our flying hours are capped. Roughly 98% of what we do is pre-planned, the remainder gives us the ability to be reactive to the needs of the community." During the 2009 season, BBMF flew more displays and flypasts than ever before – this is about 30% up on five years ago. "The Flight is now at its maximum capacity with the assets available – we are not looking to expand."

The 'Boss' is the only full-time pilot on the unit, all the others being, in Ian's words: "Weekend warriors; they come to work on a Saturday and go home to 'proper' jobs on Sunday evening". This leaves the OC with all the headaches of administration, planning, training and the myriad other things that come along while running what would be deemed a squadron elsewhere in the RAF. "I've had four great years of leaving it to Al [Pinner], and now it's my turn."

The idea of the OC having an 'understudy' who will in turn take command for a period of three years is to allow for a build-up of flight time in the operation of a dozen historic aircraft. This four-year 'apprenticeship' gives an average of 50 to 60 flying hours per year amounting to around 200 hours on the hand-over. This experience allows the 'Boss' sufficient time in the logbook to carry out air tests of the fighters when they come out of maintenance and to be able to convert fast-jet pilots to the nuances of Hurricanes and Spitfires.

Ian has indelible memories of his first time in a Spitfire – it was the 'baby', Mk.II P7350. It was the then OC Clive Rowley who let him go, but not before explaining the provenance of the aircraft he was about to take aloft... It was made very, very clear that it was precious and Ian wasn't!

The over-riding notion governing the operation of the aircraft by the BBMF is to bring the aircraft back. Safety parameters are not to be interpreted, they are to be adhered to. The aeroplane is more important than the task. The 'Boss' has to be sure that the pilot for a first flight is more than prepared. Ian: "I appreciate that sending someone off will be a stressful time for the OC – I know full well what that meant to me when Clive let me go." Ian has flown the 'Lanc' and will do the Dakota conversion course so that he can have direct experience of the multi-engined training regime and to give him an insight into how the crews inter-relate.

PASSION AND DETERMINATION

There is no hiding that Ian is very pleased to be on the Flight and now to be the 'Boss'. "Finally I'm here, this has been four years in the coming and I am honoured to be in command." Another sentence summed up his determination: "I will walk over hot coals if it will help the Flight."

His motivation for this command is more or less genetic. Ian's father served in the RAF and he flew his proud son in a Chipmunk. Ian's topic for his history 'O' Level examination was the Battle of Britain - he would have entertained no other subject!

Ian: "My aspiration was to do nothing other than fly a Spitfire or a Hurricane." His philosophy in life – that you make your own luck – comes over very quickly and it's infectious.

Early in his flying career, Ian found the RAF wanted to take him on a different course from the one he anticipated and he nearly left the service. He stuck with it and found himself flying the mighty Chinook in Germany.

While with 18 Squadron he had the chance to fly in DH Mosquito RR299 in 1987. "I decided there was no other course than to simply ask: 'Can I have a go?'" It was a pivotal moment, he clocked about an hour's worth of flying. "The honour of sitting between two Merlins cannot be described."

With his eye permanently on flying a Spitfire, Ian owned and operated a Christen Eagle sport biplane for 13 years. This was not happenstance; he wanted to build his tailwheel time. In 1996 he flew for a short while with the Duxford-based Old Flying Machine Company. In recent years he flew the Jaguar on operations and was also a member of the Red Arrows for three years.

Ian sums up the qualities needed by anyone on the BBMF. "You need passion, to be of a singular mind and have total determination."

A 21st Century Farnborough

Tony Dixon discovers how Farnborough airport has developed from a 20th century military test establishment into a 21st century regional business hub.

A three-bay hangar capable of handling aircraft up to Boeing BBJ and Airbus Corporate Jet size has been constructed. TAG IMAGE

WELCOME TO THE PAST & THE PRESENT

It is my pleasure to welcome you to TAG Farnborough Airport, where history and the future meet. The birthplace of British aviation now offers an unrivalled service, dedicated exclusively to business aviation.

Since 1998, when the MoD began handing over control, TAG has invested more than £100m to transform the airport, constructing state-of-the-art buildings and installing sophisticated air traffic management systems. TAG Farnborough Airport is now the most modern business aviation airport in Europe and is renowned for its world-class facilities.

Farnborough has been home to the International Airshow since 1948 and TAG Farnborough Airport is proud to continue hosting the famous show today. The Airshow is regarded by the aerospace industry as one of its most significant showcase events, attracting international VIPs, leading aviation and related businesses, press and spectators from around the world. TAG remains committed, now and in the future, to supporting this biennial event.

I hope you enjoy this year's Farnborough International Airshow.

Brandon O'Reilly
CEO, TAG Farnborough Airport

Brandon O'Reilly, Chief Executive of TAG Farnborough Airport. TAG IMAGE

Below: ***The interior of the new terminal building.*** TAG IMAGE

Farnborough Airport has an impressive aviatio history – it was the first operational airfield i the UK and has enjoyed an uninterrupted use b a wide variety of different aviation bodies since 1905.

Following the development of a balloon factory fo the Royal Engineers in 1905 and Samuel Cody's firs powered flight in 1908, Farnborough was the sit of a Government-owned aircraft factory in the Firs World War and the centre of military and civil aviatio research and development in the UK until the 1990s.

In April 1991 the United Kingdom's Ministry o Defence declared the airfield at Farnborough surplu to requirements, thus paving the way for a privat company to run the site. Around six companies wer involved in the final bidding and TAG Aviation, part o the Swiss TAG Group, was awarded a 99-year lease t run the facility.

In the early 1980s, a Government review of business je airport capacity in the London and south-east England area culminated in a White Paper in 1985, reachin the conclusion that the growth prediction for suc traffic, and its importance to the UK economy, mean that existing facilities would soon be unable to cope According to the White Paper, "Farnborough would be a very good place for a business aviation airport t relieve stress at Heathrow and Gatwick." One of th main reasons TAG was selected to run Farnborough wa that it was prepared to focus purely on the business je operation rather than on developing ancillary activities such as cargo.

Transferring the airport from military to civil use wa complex - a number of items required improving o constructing. "It was a CAA [Civil Aviation Authority requirement to construct a new ATC [Air Traffic Control Tower, staffed by subcontracted NATS [National Ai Traffic Services] employees, and install a Category ILS [Instrument Landing System] on the runway," sai Roger Walker, Director of Airport Aviation Service during 2006. "The runway also had to be re-profiled an

Opposite: ***The new passenger terminal and operation building opened in January 2006.*** KEY - Tony Dixo

FARNBOROUGH'S VITAL STATISTICS

IATA Code:	EGLF
ICAO Code:	FAB
Position:	N5116.9 W00044
Elevation:	238ft (72m)
Runway:	06/24
	5,900ft (1,800m) landing
	6,500ft (2,000m) take-off

resurfaced." The re-profile issue was important as TAG had to satisfy different obstacle clearance requirements from those used by the military operators; this involved removing obstructions (including 16ft (5m) of earth from the top of a hill) and extending the runway so that the thresholds could be adjusted to give better obstacle clearance on the approaches. A completely new ground lighting system was installed for approach, runway and taxiway systems. The CAA licence came into effect o January 1, 2003 and TAG bought the freehold of the site at the end of 2007.

The nature of the passenger operations means that the departure lounge, which overlooks the main apron, is never crowded. TAG IMAGE

Farnborough's space-age control tower is the most easily recognisable change to the skyline, constructed in 2002. TAG IMAGE

TECHNIQUES D'AVANT GARDE (TAG) IN THE UK

Also based at Farnborough, TAG Aviation (UK) is engaged in the charter and management of business jet aircraft and holds a Type B AOC issued by the CAA. TAG Farnborough Engineering is also based on the airfield and holds EASA145, FAA, Russian, South African, Cayman, Bermuda, Bahrain, Nigerian national approvals, together with Manufacturers' Approved Service Centre status for Bombardier, Dassault Falcon and Hawker Beechcraft providing maintenance (base & line) plus engineering Part M Sub Part G services on a variety of business jets. The company also works closely with local colleges for engineering apprentices and the 'TAG family' at Farnborough employs just over 300 workers.

The airport operates under a number of constraints only business aircraft can use the airfield, wit scheduled passenger, bulk freight services, tour, charte and recreational flying not allowed; freight is limited t 220lb (100kg) per aircraft, except for the movement o racehorses; there is a limit of a total of 28,000 take-off and landings per annum, of which no more than 5,00 can be at weekends or bank holidays; noisier aircraf have been phased out in order to comply with a 'noise budget'; flying can only take place between 0700 and 2200 on weekdays and 0800 and 2000 at weekends and bank holidays; aircraft are limited to types with a manufacturer's maximum take-off weight below 50 tonnes (although an exception is made for up to 1,500 movements per annum by purpose-designed business aircraft up to 80 tonnes, to accommodate the Boeing Business Jet and Airbus Corporate Jet). A small amount of aviation by the Government (military and Royal Flights), the small based flying club and for the biennial Farnborough International Airshow is allowed outside some of these stipulations.

As a part of the planning permission, a number of environmental controls were established, which came into effect on January 1, 2003, when the CAA licence was granted. One of the environmental requirements is the preparation of quarterly and annual monitoring reports summarising environmental performance and noise and air quality.

In 2009 the airport recorded about 23,000 annua movements. Roger Walker: "In the Air Traffic Contro tower, the radar room provides the busiest LARS [Lower Airspace Radar Service] in the country. We have also done a large amount of work with the Environment Agency, with the provisioning of balancing ponds for water storage in times of flood and the re-routing and deepening where necessary of local streams. We have constructed a new fue farm and can also provide de-icing of aircraft wher necessary – with all the associated drainage measures to prevent contamination of the environment. For aircraft movements, a sophisticated track and noise monitoring system is installed and we can analyse the source of any complaints quickly. Quite often we find that the aircraft involved is not from Farnborough but is in transit to one of the other London airports."

With a cap of 28,000 movements annually, it might be imagined that a large passenger terminal would be needed. A 50,000sq ft (4,620m²) state-of-the-art terminal building opened in January 2006 in place of the temporary structure in use since TAG took over, featuring all the security measures required at larger airports, and has lounges for outbound passengers. The building also includes airport operations, crew room, cafe and offices (and the UK headquarters and operations) for a number of business jet manufacturers, among them Bombardier and Cessna.

The 120,000sq ft (11,150m²) three-bay hangar can house up to six Boeing BBJ-sized aircraft, but is normally used by a wide variety of smaller executive jets. Such is the growth in demand in the business sector that TAG is building another three-bay hangar of similar size to the west of the current building, which will be completed in time for the London Olympic Games in 2012.

The view from the top of the Air Traffic Control tower is impressive, showing the new hangar and terminal and the operations building, plus a busy ramp. TAG has guaranteed the future of the Farnborough Air Show for at least the next 16 years. KEY - TONY DIXON

FlightSafety's two-storey building to the east of the executive jet terminal at Farnborough houses 15 full-flight simulators. The first to be certified for use was a Raytheon/Beech B1900D in July 2005, which has been joined by a Cessna Citation Bravo, King Air 200, Saab 340, Gulfstream IV and a Hawker 800XPH, Citation Excel, Hawker 800XPC and a Hawker 400XP. KEY - TONY DIXON

Other recent developments include the construction of the 'Aviator' luxury hotel on the airfield perimeter - its contemporary design was chosen to complement the rest of the airport's infrastructure. It has 150 bedrooms and 19 suites and a brassiere, two bars and a deli, plus boardroom and meeting facilities for delegates flying into the airport.

FUTURE DEVELOPMENTS

TAG is seeking permission to increase annual movements to 50,000, but assures locals that it can be done within environmental and safety constraints and existing operating hours.

A public inquiry was held in May and June 2010 and a decision by the Joint Secretaries of State is expected in due course.

WHY FARNBOROUGH?

Brandon O'Reilly, Chief Executive of TAG Farnborough Airport said "TAG Farnborough Airport offers a dedicated business aviation service, rather than private jet handling as part of a larger commercial airport or small aero club. Farnborough is unique in this sense and provides a level of service unmatched at any other facility in Europe. The buildings are award-winning architectural masterpieces of modernity and function, which afford our customers privacy, space, calmness and efficiency."

Artist's impression of Bloodhound SSC at speed.

BLOODHOUND SSC modelled in NX

SIEMENS

Sniffing for a record

Richard Noble and Wing Commander Andy Green have teamed up again for another attempt on the World Land Speed Record – this time a Bloodhound will take them through the 1,000mph barrier and beyond in the summer of 2011.

It was in London on October 23, 2008 that the Bloodhound SSC project was formally launched to the public. At the Science Museum, Lord Drayson, then Minister of State for Science and Innovation announced the three-year mission led by Richard Noble OBE to create a land speed record car capable of achieving 1,000mph.

Noble's track record is impressive – mastermind of the successful Thrust SSC record attempt in 1997, he has pioneered both new car and aeronautical products over the last decade. Joining him for the new record attempt is Royal Air Force pilot Wing Commander Andy Green, who drove Thrust SSC to speeds faster than any human being had achieved on land before.

Richard Noble: "This is the most extraordinary project I have ever been involved in. We're building the most advanced land speed record vehicle that's ever been built. The intention is to share the project as widely as we can – but the key thing is education. People love engineering – at the speeds we'll be going, loads are in the order of 12 tonnes a square metre. It's got to be as tough as a submarine!" Andy Green: "It's intended to get everyone interested in mathematics, engineering, science and technology. I am a Royal Air Force fighter pilot but first and foremost a mathematician; I'm fascinated by the extraordinary numbers that Bloodhound SSC is throwing up."

In 1997 Andy Green set the current record of 763mph (1228km/h) at the controls of Thrust SSC on Octobe 15, 1997. When Bloodhound SSC achieves its targe of 1,000mph (Mach 1.4), it will mark the greatest incremental increase in the history of the World Lan Speed Record and will also exceed the low-altitud speed record for aircraft (c.994mph)! Building a car tha is quicker than a fighter jet is not, however, the primar goal of the project; it is to inspire future generations t take up careers in science, technology, engineering an mathematics (STEM subjects) by showcasing them i the most exciting way possible.

As the ultimate, unlimited racing car, Bloodhoun SSC will also be the catalyst for a raft of cutting-edg research in fields such as aerodynamics, computationa fluid dynamics, materials technology, composit manufacturing and sustainable high-tech engineering. The numbers, as Andy Green says, are staggering: th jet and rocket-powered vehicle will be faster than a bullet fired from a handgun and its wheels will spin a over 10,000rpm, generating 50,000 radial g at the rim. Bloodhound SSC will accelerate from 0–1,050mph in 4 seconds and at top speed will be covering a distanc equivalent to over four football pitches every second.

Lord Drayson said "Breaking world land speed record is no longer about strapping an engine onto a buggy and pointing it at the horizon. Today, the application o new and exciting science and technology is the only wa to achieve such results. If Bloodhound SSC is to reach it

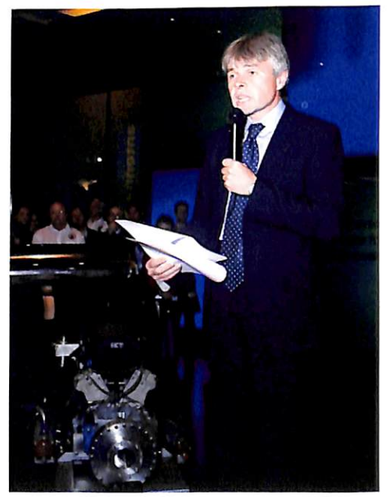
ABOVE: ***Richard Noble OBE, Project Director.***
RIGHT: ***Lord Drayson speaking at the press launch in 2008.***
BELOW: ***Richard Noble and Wing Commander Andy Green.*** ALL IMAGES COURTESY BLOODHOUND SSC

target of Mach 1.4 the team behind it will need to solve some ambitious challenges in science, engineering and maths. From constructing the largest hybrid rocket motor ever built in the UK, to making major advances in sensor technology and designing wheels to cope with these incredible forces. Britain has a wonderful heritage of rising to the challenge and this exciting project will see that continue. The development from the drawing board to reality will be open for all to see at every stage. The project's involvement with young people is vital to inspire them about the exciting things that can be achieved by science and engineering. Ultimately, I hope that this iconic British project will encourage the next generation of scientists and engineers as we will depend on them to find the solutions to everything from climate change to growing population pressures."

Bloodhound SSC is a private venture, funded through sponsorship. The UK Government is part funding the three-year education programme, but not the build and running costs of the car. It currently has over 150 sponsors, ranging from specialist product suppliers such as Goodridge Hoses to multinationals such as Lockheed Martin and IT partner Intel.

DESIGNING A RECORD-BREAKER

"We have chosen a jet and hybrid rocket," said Noble. "The reasoning is that we need the rocket for its raw power and lack of 'draggy' air intake, but the downside is that the rocket is an on/off device and



Side profile of Bloodhound SSC.

with rocket power alone we would have real difficulty hitting and holding selected Mach numbers for the aerodynamicists to gain their data. At these speeds we have to tread very carefully, increasing the Mach numbers in small, careful steps.

"The car has to run through a wide speed range and keep the same loads on all four wheels. Small winglets above the wheels are fully dynamic trimmers, making small adjustments in fractions of a second. In the middle is the MCT V12 800bhp race engine, doubling as an Auxiliary Power Unit to start the EJ200 jet engine and pump the High Test Peroxide (HTP) through to the Falcon rocket. The beauty of the hybrid rocket is that it uses a safe and green oxidiser in the shape of HTP and only burns its solid fuel as long as the HTP is flowing."

Bloodhound SSC will feature the largest hybrid rocket ever designed in the United Kingdom, weighing in at 400kg. It is 45cm (18in) in diameter and, at 425cm (14ft) long is the same length as a Formula One racing car. It is designed to produce 122kN (27,500lbs) of thrust, so together with the Eurojet EJ200 jet engine will give the car a total of 212kN (47,500lbs) of thrust – the equivalent of 135,000hp, or the power of 180 Formula One cars.

On October 17, 2009, the team of experts, led by 25-year-old rocket engineer Daniel Jubb, successfully fired the first prototype rocket in the Mojave Desert in the USA.

Bloodhound SSC will be completely different to anything seen before. Noble continued: "We need to minimise the cross-sectional area to minimise drag, but we also need a supersonic intake and a smart suspension system that will enable the car to run smoothly over the rough salt surfaces. In Thrust SSC, Andy's cockpit was positioned comfortably between the two Rolls-Royce Spey 202 afterburning turbofan engines, but in the Bloodhound design packaging of all the components, including Andy, has been a difficult issue. He and his cockpit have ended up just under the EJ200 intake, with the cockpit external shape being a part of the all-important intake shock management structure. Andy has lost out on comfort value there, but that's one of the compromises that have been necessary in developing a Mach 1.4 car.

"The rear wheel covers are going to attract considerable attention as they look like something from a sci-fi movie! We have to reduce supersonic drag; hence the pointed parts front and rear. The fin is also very small – traditionally these Land Speed Record cars have had big fins to ensure good stability in yaw, but too much fin means the car would be severely affected by crosswind. One of the key design issues is whether we have enough fin area to control the car directionally when we bring in the afterburner and the rocket at low Mach numbers. When we finally determined its shape, I was very pleased – like I said earlier, it looks like nothing we have ever seen before. And that's just how it should be…"

VENUE FOR A RECORD

The project team scoured the globe looking for the perfect run location on which to make the record attempt. The site needed to fulfil some very specific criteria: it had to be ten miles long, have one mile of clear run-off at each end, be dead flat, and firm enough to support a 6.5 tonne car moving at high speed. Several thousand possibilities were whittled down using Google Earth to a short list of 35 deserts and salt flats, including: Bonneville Salt Flats and the Black Rock Desert, USA; Lake Tuz, Turkey; Verneuk Pan, South Africa; plus Lake Gairdner and Lake Eyre, Australia.

Andy Green visited the majority of these deserts to conduct on-site surveys, and Hakskeen Pan in Northern Cape Province, South Africa was selected. Hakskeen Pan offers a 12-mile long track across a perfectly flat dried-up lake bed with a surface relatively free of debris and stones. The Project has received support from the Northern Cape Government, which has undertaken to prepare Hakskeen Pan for the World Land Speed Record runs as part of the Northern Cape's development as a world-class adventure sports location.

EDUCATION PROGRAMME

The Project has over 2,410 primary and secondary schools, 176 further education colleges and 33 universities signed up. An independent study by the National Foundation for Educational Research (NFER) concluded that the Bloodhound SSC Education Programme provides a genuine 'hook' to get children interested in science and engineering. Siobain Barr from Harwood Meadows Primary School in Bolton, who uses the resources in her classroom, said: "Our pupils are blown away to be involved in such an exciting project and enthusiasm is equally high from girls as well as boys. They're enjoying maths without realising they're learning!"

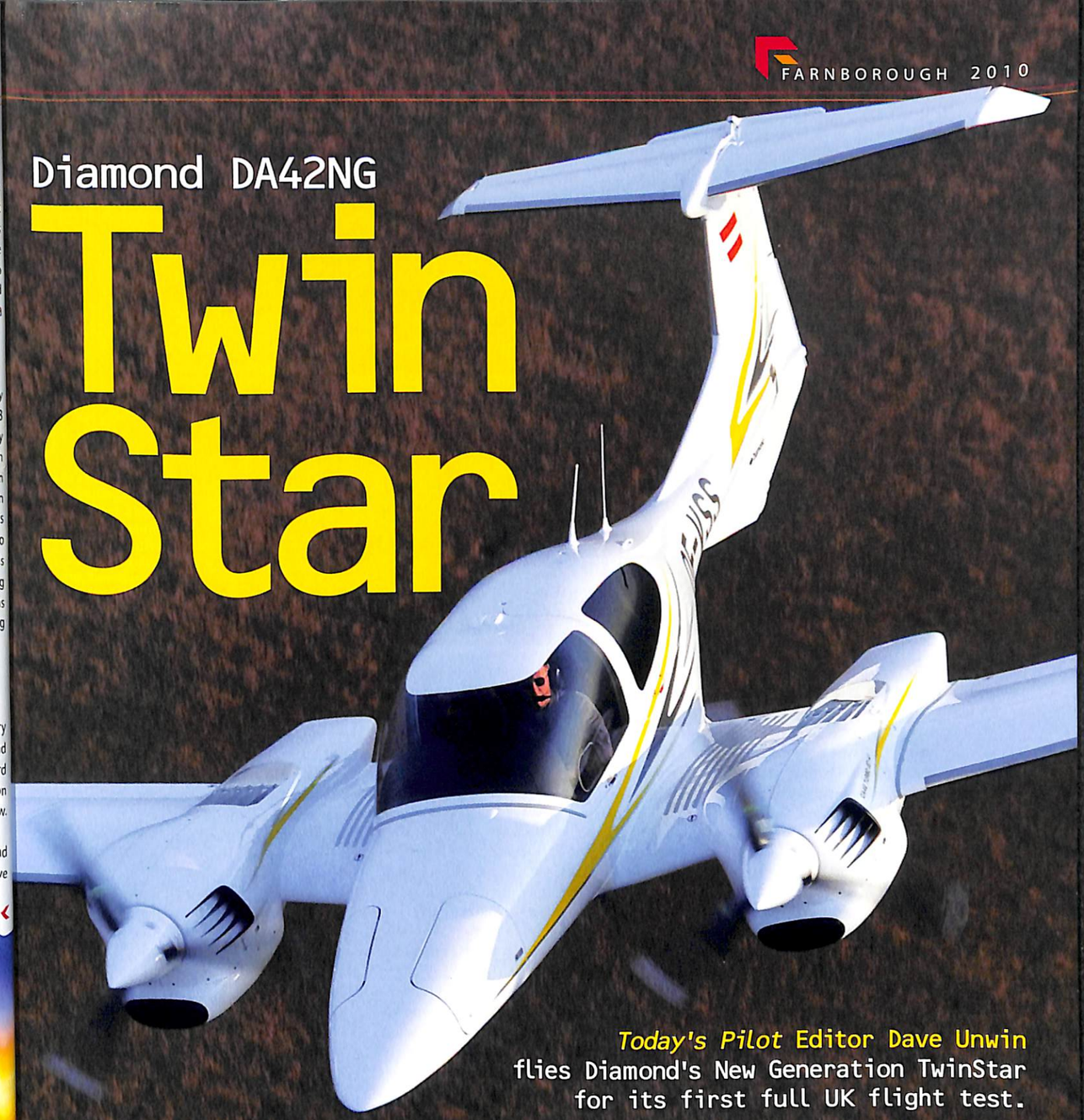
BECOME PART OF THE ADVENTURE!

Fans can become part of the project and part of history by having their name on the tail fin of Bloodhound SSC when it sets out on its World Land Speed Record run. There is limited space on the fin and a donation of £10 or more secures a spot – just log onto www.bloodhoundSSC.com/fin.cfm

You can also join the '1K Club', the official Bloodhound SSC supporters' club. Members are invited to exclusive open days allowing them to see, first-hand, the progress of the Project and meet the team.

Artist's impression of Bloodhound SSC at speed.

Diamond DA42NG Twin Star



***Today's Pilot* Editor Dave Unwin flies Diamond's New Generation TwinStar for its first full UK flight test.**

As the TwinStar surged forward I recalled that during the briefing Diamond Aircraft UK's Henrik Burkal had mentioned that the extra power from the new Austro engines had transformed the aircraft. He clearly wasn't exaggerating!

Standing out on the ramp at Diamond UKs Retford base the aircraft certainly looked good. Apart from the new and more powerful Austro engines the 2009 DA42 is very similar to the 2005 model that I tested four years ago. However, there are a number of significant improvements, and as I walked out to the aircraft on a fairly blustery morning in early July I was intrigued to see how many I could spot. In fact, the first one was obvious.

Although the wings retain the same aerofoil, have an identical aspect ratio and feature the same combination of split and single-slotted flaps as on earlier aircraft, one significant difference is that the leading edge is fitted with a TKS 'weeping wing' de-icing system. This involves an anti-freeze solution weeping from titanium panels mounted on the leading edges of the wings, fin and tailplane, while a 'slinger' ring inside the spinner coats the propeller. This is an optional extra, but frankly I doubt that many will be sold without this option. With its two engines and awesome avionics suite the TwinStar is a fine IFR platform. And to regularly file IFR, you really do need some sort of anti or de-icing system. The 30-litre tank for the TKS fluid is housed on the right side of the nose baggage bay. The nose bay can carry up to 30kg, and this obviously allows the pilot a great deal of flexibility when loading the aircraft as they can optimise the CG.

As Henrik and I continued the preflight inspection he also showed me some of the other design changes. As mentioned earlier, the original 135hp Centurion engines have been replaced by 168hp Austro AE300s. These turn three-blade MT composite propellers, which are constant speed and fully-feathering.

The new engines are not only larger and more powerful than the Thielert motors, they are also heavier. This has required the engine mounts and undercarriage to be strengthened. As I continued around the aircraft I noted that it has retained all of the aerodynamic refinements that had impressed me when I flew the earlier version. The relatively high aspect-ratio wings are beautifully made, and feature sexy-looking swept-back, up-turned, winglets. Unusually, the TwinStar is fitted with two

The panel is dominated by the Garmin G1000's dual screens, while the standby instrumentation is an electric attitude indicator plus an analogue ASI and altimeter. ALL DIAMOND AIRCRAFT

different types of flap. Inboard of the engines the flaps are of the simple split variety, while outboard they are of the more sophisticated single-slotted type.

The inward retracting trailing-link main undercarriage units look very robust. If you were wondering why the main undercarriage doors do not cover the wheels completely when the undercarriage is retracted, it is because the undercarriage's VLE is the same as the aircraft's VNE. This allows the pilot to use the undercarriage as a rudimentary airbrake.

Access to either the front or back seats is very good. The canopy opens wide and is well supported on a tubular steel yoke. As mentioned earlier there are sensibly-sized non-slip walkways on both wingroots, and there is a grab handle mounted in the canopy frame to help you lower yourself down onto your seat. Access to the rear seats is a via a big gull-wing door on the left side. Well located grab handles built into the roof interior make getting in and out of the back seats far easier than most four-seaters. Behind the rear seats is a spacious baggage bay that can carry up to 45kg.

As I settled onto my seat Henrik explained that another improvement is that the rudder pedals are now adjusted electrically. I did think that this was perhaps a bit OTT for a four-seat light twin, but apparently using this system provides another 3.8cm of travel. The seats remain fixed.

As I began to take stock of my surroundings it occurred to me that someone at Diamond Aircraft has clearly made the connection that if you can afford to spend €500,000 on an aircraft, then your car is also most probably quite expensive. The interior of the NG strongly resembles that of a luxury car and has that almost indefinable 'touch of class'. As well as being comfortable, the seats are also extremely strong. The cockpit structure features an integral roll-cage.

Compared to many four-seat aircraft, the cabin is large, with plenty of room for four adults. Furthermore the large windscreen and big side windows let in plenty of light to create an airy, spacious feel. A quick calculation revealed that with four 80kg adults and full fuel the useful load of 485kg means that there is still a couple of kilos left for baggage. Pretty impressive, as there aren't many four-seaters that will carry four adults with full tanks, let alone still be able to carry baggage.

With my pedals set and harness buckled I began to reacquaint myself with the overall layout of the controls and instruments. I was particularly interested to see what changes had been incorporated since I'd last flown a TwinStar and – more importantly - whether they were for the better!

The cockpit and instrument panel is essentially the same as on the earlier TwinStars I'd flown, although it did seem to me that the windscreen was slightly deeper. Other changes are that the autopilot is now a fully integrated Garmin GFC700, complete with yaw damper and a Flight Director. One of the aspects of the original TwinStar that really impressed me was how logically laid out and uncluttered the cockpit is – and Diamond's engineers have resisted the temptation to try and improve upon what was already a very good panel. The panel is dominated by the Garmin G1000's dual screens, while the standby instrumentation is an electric attitude indicator plus an analogue ASI and altimeter. There are no vacuum pumps – which certainly got my vote as I've never liked them! The flap and undercarriage controls are exactly how I would've designed and located them. The undercarriage selector is wheel-shaped, has co-located position indicator lights and on the left side of the panel. The aerofoil-shaped flap switch is on the right side of the panel, is guarded and simply has three positions - 'Up', 'Approach' and 'Landing'. Lights next to the flap switch indicate when the flaps have reached the selected position. The limiting speeds for 'Approach' and 'Landing' are printed next to the lights. All the circuit breakers are on the right side of the panel, and there are large rigid pockets for the POH, charts and airways manuals built into the cockpit sidewalls.

The stick and power levers (strictly speaking they're not throttles, as they control both the engines and the props) fall nicely to hand, as do the secondary controls. The stick tops carry rocker switches for electric pitch trim, along with a PTT and autopilot disconnect, while the thrust levers now incorporate a TOGA button. These are located in a centre console which drops down from the base of the panel and extends aft between the seats. The console also carries a large elevator trim wheel and co-located indicator, rudder trim knob, the fuel shut-off and crossfeed selectors and levers for the parking brake, cabin temperature control and canopy de-mist. In fact, these levers could be better designed – as in my opinion they are not as sufficiently different from each other as they could be. Look closely at the cockpit picture and you'll see what I mean.

Time now to start the engines. This is an astonishingly simple procedure. Just turn the master switch on, ensure the power levers are on the idle stops and flick the left engine's Electronic Control Unit (ECU) toggle switch to 'on'. Then, as soon as the 'glow plug' caption on the multi-function display (MFD) extinguishes turn the key towards the left engine. The prop barely begins to revolve and it starts. Just like that.

At the run-up point I set the parking brake, ran the engines up and pressed the engine test buttons. Each ECU then runs through an extensive self-test procedure, which even includes cycling the props. A procedure I hadn't seen before is that as the AE300's have dual ECU's part of the pre-take off checks requires selecting using a small 'voter' switch to select each ECU off in turn. This checks that both are functioning correctly. The engines 'blip' momentarily as you do this – it is not unlike the traditional 'mag' check. Something else that is new is that the NG is fitted with a stick limiting device. Henrik directed me to lower the flaps, hold the stick fully aft and increase power. As the power loading rose past 25% (the primary power indication is shown as a percentage) I distinctly felt the stick move forward. This is to protect against an inadvertent stall with full flap and high power settings. Overall the pre-take off checks are very straightforward - indeed we did not even use the electronic checklist that is incorporated into the MFD. It includes normal, abnormal and emergency procedures.

Having back-tracked to the start of runway 21, I noted that the windsock was cavorting about a bit (it was a very convective day, with occasional thunderstorms forecast) but that essentially we had a crosswind of about 10kts/30° from the right. With the aircraft aligned with the centreline I smoothly opened the power up against the brakes. As soon as the power stabilised at 100% I released the brakes and we were off! With only Henrik and I aboard and about 100 litres of Jet A-1 in the tanks we were a long way below MAUW, but even taking this factor into account I could sense immediately that the increase in power provided by the Austros had definitely transformed the TwinStar. The acceleration really was very good, and after a ground roll that I would estimate as being only around 400m I rotated at 80kts. Retracting the undercarriage produced no significant change in pitch.

Having engaged the yaw damper, Henrik suggested that we climb up to 10,000ft for a look at the cruise and then some general handling. Vy is 100kts, but this produces such a steep deck angle that visibility over the nose is actually impaired so I told Henrik I'd trim for 110 and he nodded approvingly. Another facet of the TwinStar that I approved of is that while it has a nicely geared electric pitch trim system, it has also retained the large wheel in the centre console. When I flew a TwinStar back in 2005 I commented that I'd felt that the electric pitch trim was geared too high, and that the manual trim wheel was a bit 'notchy'. On the NG it seemed to me that the trim wheel was very smooth, and the gearing on the electric trim 'about right'. Having flown with Henrik before I wasn't at all surprised when he suddenly simulated a failure of the left (critical) engine by quickly pulling its power lever back to idle. As we were well above the VYSE of 85kts the yaw was easily contained with rudder. I then promptly trimmed the pedal loads out, noted that we were still climbing at around 400ft/min and observed to Henrik that "I was flying a clunky old 152 a few weeks back that didn't climb this well!" I then tried a few 90° turns, both into and away from the 'dead' engine. As the left engine was still idling the prop had not auto-feathered, which meant that it was generating a lot of drag. Nevertheless, controllability was never in doubt, and I could have comfortably flown the aircraft for several hundred miles if I'd had too. Henrik offered to shut down the engine entirely, but as the blades would auto-feather once the engine stopped (greatly reducing the drag) I thought that this would make it too easy and consequently declined. But what an impressive demonstration – particularly when you bear in mind that (as the TwinStar does not have counter- rotating propellers) I was climbing comfortably with the critical engine windmilling!

Happy that I was suitably impressed (and I was) Henrik slowly increased the power on the left engine, I returned the rudder trim to neutral and we continued up to 10,000ft. At this height the Austro's turbos ensure that they are still capable of producing 100% power. However adjusting the power to a more 'normal' cruise setting of 75% soon saw the TwinStar indicating a steady TAS of 170kts. The ride was agreeably 'firm' – doubtless due to the higher wing loading.

Henrik then pressed a few buttons and a map of Europe appeared on the MFD. There was a small aeroplane icon in the centre and a dotted red circle superimposed over the map. Basically, it was currently possible for us to reach any point on the map that was within the red circle. "Now, watch this Dave" he said and pulled the power back to 55%. Although the TAS only dipped by about 15kts, the red circle had not only expanded considerably but was now more oval than circular. This was because it takes the headwind or tailwind component into account, and we'd obviously go much further downwind at the slower, more fuel efficient speeds. What a system!

Time now for some general handling, so I increased power back up to 75% and began a series of 360° turns. As I remembered, the primary controls are all good, with the ailerons, rudder and elevator being nicely weighted and well balanced. There is little 'stiction' in the control circuits and the breakout forces are minimal. Harmony of control was also good – with the rudder being the heaviest to operate and the ailerons the lightest. The ailerons are perhaps a trifle heavy – especially at speed – but then this aircraft has been primarily designed as a tourer. However, the steep turns also reminded me that

An examination of the stick-free stability revealed that it is neutrally stable laterally, positively stable longitudinally and strongly positively stable directionally.

The primary controls are all good, with the ailerons, rudder and elevator being nicely weighted and well balanced.

I would still prefer a concertina-type sunshade over the built-in one that is currently fitted. It wouldn't be as pretty, but it would be more practical, as it would provide more shade in the cruise and better visibility in the circuit.

An examination of the stick-free stability revealed that it is neutrally stable laterally, positively stable longitudinally and strongly positively stable directionally. The very strong directional stability is because the sum total of the big fin and rudder, ventral strake, dorsal fillet plus the relatively large winglets adds up to a substantial amount of keel area. Some stalls – both 'clean' and with different configurations of flap and undercarriage revealed the TwinStar to be very benign. Even stalling in a turn with the undercarriage and flaps down proved to be a bit of a non-event. As the stall is approached light buffeting can be felt through the stick, while at our weight and relatively forward CG it finally and reluctantly quit flying with an IAS of about 56kts. Applying the correct recovery procedure was both effective and immediate.

I then engaged the powerful Garmin GFC700 autopilot and we descended into the clouds. The ride quickly got very bumpy, and I hurriedly drew the power levers back and turned 90°. The rain suddenly increased until it really was pounding against the windscreen, the turbulence increased still further – and then we popped out into the clear. Suddenly the 'master warning' sounded and the 'RH ENG FIRE' caption lit up! We both quickly studied the right nacelle and then looked at the engine's Ts & Ps. All were normal. "Don't worry Dave" laughed Henrik as he made a note on his kneeboard. "Remember this is serial number one! We're still ironing a few bugs out. That very heavy rain somehow got inside the nacelle and generated a spurious warning."

The next item on the flight test card was to shoot an ILS, so I accepted vectors for Doncaster's runway 20. Henrik asked me if I wanted to fly the full procedure, but although I have held an FAA CPL/IR for 20 years, I really am very rusty on instruments. Nevertheless, I decided that I'd actually shoot the approach with 'raw data' only (ie no flight director). If I'm honest, I started badly, and although I managed to nail the localiser quite quickly my relationship with the glideslope was far from satisfactory! However, I eventually sorted myself out, and when Henrik told me to look up at 300ft I would have easily made the runway. However, I must emphasise that the approach's satisfactory outcome says a lot more about the TwinStar and its G1000 than it does about me! This really is a very easy – and safe – aircraft to fly. Having gone around at 300ft we then headed back to Retford for some touch-and-goes. Henrik recommended leaving the power set at 50% and lowering the undercarriage and 'approach' flap on the downwind leg at a speed of 120kts. By now I'd noticed that all the speeds Henrik gave me were slightly faster than on the earlier aircraft. I ascribe this to the higher wing loading. Although I was in the left seat and we were flying right-hand circuits the visibility is such that I never lost sight of the runway. I used about 100 'around the corner', before bleeding the speed back to 85 on final with the flaps set to landing. Henrik had mentioned that as the props go to 'fully fine' with the power levers at idle, they do generate a small braking moment, and that if I was even slightly slow to leave a trickle of power on in the flare. The first landing was pretty good – and the second one even better.

For the next approach Henrik asked me to perform a single-engine approach and go around, and he set 'zero thrust' (ie simulated that the 'failed' engine was feathered) on the left engine. This is a manoeuvre that has killed literally thousands of pilots, but the TwinStar handled it with aplomb. I did notice that the aircraft definitely 'settles' as the flaps come up during the go-around. It is not an issue (and Henrik had mentioned it during the pre-flight briefing). However, I would certainly advise against retracting the flaps at low altitude.

In conclusion I have to admit to being very impressed with the TwinStar NG. Indeed, I could only snag it on a couple of minor gripes – and these are probably subjective anyway! It's fast, comfortable, economical and has very impressive numbers for range and endurance. It also looks great, but - most importantly - is very easy to fly. Indeed, when compared to the Twin Comanche that I did my multi-engine instrument rating in – well, there's no comparison!

DIAMOND DA42NG TWINSTAR

DIMENSIONS		
LENGTH	8.56m	28ft 1in
HEIGHT	2.49m	8ft 2in
WING SPAN	13.42m	44ft
WING AREA	16.5m2	177.2sq ft
WEIGHTS AND LOADINGS		
EMPTY WEIGHT	1,415kg	3,119lb
MAX AUW	1,900kg	4,189lb
USEFUL LOAD	485kg	1,070lb
WING LOADING	115.15kg/m2	23.63lb/sq ft
POWER LOADING	7.6kg/kW	12.46lb/hp
FUEL CAPACITY	195lit	42.9Imp gal
PERFORMANCE		
VNE	194kts	360km/h
CRUISE (TAS)	184kts	341km/h
STALL	61kts	113km/h
CLIMB RATE	1,150ft/min	5.8m/sec
SERVICE CEILING	18,000ft	5,486m

ENGINES

2 x Austro Engine AE300 four-cylinder inline liquid-cooled turbocharged common rail diesels, producing 168hp (125kW) each

PROPELLERS

2 x MT composite three-blade constant speed fully-feathering

MANUFACTURER

Diamond Aircraft Industries GmbH, Weiner-Neustad, Austria
Tel: +43 262226700 Fax:+43 262226780
Email: office@diamond-air.at Web: www.diamondair.at

UK DEALER

Diamond Aircraft
Tel: 01777 839200 Fax: 01777 839300
E-mail: henrik@diamondair.co.uk Web: www.diamondair.co.uk

You asked, we delivered...

MERLIN MK3 DEPLOYMENT TO AFGHANISTAN

The UK MoD/AgustaWestland Strategic Partnering Arrangement enabled the Merlin Mk3 to be fitted with all the required theatre standard modifications for Afghanistan and deployed with full support one month early...

...on time and on budget.

AgustaWestland
A Finmeccanica Company

agustawestland.com

Boeing's Big Year

ABOVE: *Chief Test Pilot Captain Mike Carriker in ebullient mood after the first flight of the 787 on December 15, 2009.* ALL IMAGES BY BOEING

MAIN IMAGE: *ZA001, the first 787, makes its maiden flight on December 15, 2009.*

Boeing's test fleet has been an incredibly busy since last December with the first flights of both the 787 Dreamliner and 747-8 updated Jumbo Jet. *AIR International* and *Airliner World* magazines have been covering the action.

Ready... steady... now," said Chief Pilot Mike Carriker to co-pilot Capt Randy Neville as he released the brakes for take-off. Powering down runway 34L at Paine Field in Everett, Washington, Carriker eased Boeing 787 Dreamliner N787BA/ZA001 into the air for the first time at 10:27 on December 15, 2009.

Once airborne, he climbed to 2,500ft (762m) to avoid entering the clouds and immediately undertook the first test points of the flight. The pilot then received clearance from air traffic control, and called the engineers on the ground monitoring the telemetry, advising them that he had control of the aircraft and was ready to start the first flight test.

"We popped out of the top of the clouds at about 7,000ft (2,133m) and there was the snow-capped Olympics, the Straits of San Juan, all framed in the front left window of a 787 at 10,000ft (3,048m). That image will be in my mind for the rest of my life," said Carriker. "We took off with a very aggressive plan, to fly for five and a half hours and do many test points that actually count for the final certification of the airplane. We achieved about half of those."

Describing the early part of the flight, co-pilot Capt Randy Neville said "We took off with flaps 20 [degrees], the normal take-off setting and we stayed there for quite a while. We were at flaps 20 for the bulk of the mission that was with the gear down. We ultimately got to flaps 30; we cycled the landing gear, which was a big test point. We brought the gear up and both breathed a big sigh of relief when we put it back down and it came down properly."

Because airspace with clear weather was limited and this made it necessary to make numerous turns, Carriker couldn't achieve the speed he would have liked to. Much of the flight was flown at around 160kts (184mph/296km/h), according to Neville, but the crew achieved a maximum air speed of 180kts (207mph/333km/h) and an altitude of 13,200ft (4,023m). During the course of the flight Carriker and Neville tested systems and structures, as onboard equipment recorded and transmitted real-time data to a flight-test team at Boeing Field. Due to deteriorating weather in the Seattle area, the flight was cut short and the crew flew an ILS approach to runway 13R in very wet conditions landing safely at Seattle's Boeing Field at 13:33.

ABOVE: *The 787 meets Model 40 – on May 8 Captain Mike Carriker drew ZA001 alongside a restored example of Boeing's first airliner for a unique photo opportunity.*

Seven days later, Boeing 787 N787EX/ ZA002, the second aircraft completed its first flight, in the livery of the launch customer, ANA (All Nippon Airways) of Japan. Flown by Capt Randy Neville, with Chief Pilot Mike Carriker operating as co-pilot, the crew completed a two-hour flight and also landed at Boeing Field. Boeing says there will be more than

ZA001 comes in to land at Boeing Field at Seattle. The graceful arc of the wing can be clearly seen.

3,000 flight test hours flown before the 787 is certified by the Federal Aviation Administration. The flight test programme will involve six aircraft flying nearly around the clock and around the globe. Each of them will be used for a specific set of tests.

A third aircraft joined the flight-test programme on February 24 as ZA004, the fourth flight-test airframe to be built, took off at 11:43 local time from Paine Field. ZA004 flew before ZA003 because the data it is collecting is needed more quickly, both for certification and development of the 787-9. Captains Heather Ross and Craig Bomben completed a three-hour-and-two-minute flight landing at Boeing Field in Seattle. "Airplane No. 4 operated flawlessly today," Ross said after landing. "We've got a lot of work ahead of us but I can't imagine a better start to the flight test programme for this airplane." ZA004 will be used to test aerodynamics, high-speed performance, propulsion performance, flight loads, community noise and extended operations (ETOPS). ZA003 flew on March 14 with Captains Ray Craig and Mike Bryan at the controls.

On May 12 two pilots from Japanese carrier All Nippon Airways (ANA) became the first non-Boeing company crew to fly the 787 Dreamliner during a test flight. ANA pilots Captain Masayuki Ishii, Director of 787 pre-operations planning, and Captain Masami Tsukamoto, Manager of 787 pre-operations pilots joined Boeing's Chief Test Pilot Captain Carriker and co-pilot Captain Christine Walsh for the three-hour flight.

BOEING 747-8 MAKES MAIDEN FLIGHT

The first prototype Boeing 747-8 Freighter took to the air for the first time on February 8, 2010 in front of 5,000 employees at the company's Paine Field in Everett, Washington. The General Electric GEnx-2B-powered aircraft, N747EX (c/n 35808), departed at 12:39 local time (20:27 GMT) landing back at the same airport almost four hours later at 16:18 (00:33 GMT). During the flight the aircraft underwent tests for basic handling qualities and engine performance and reached a cruising altitude of 17,000ft (5,181m) and a speed of up to 230 knots, or about 264mph (426km/h).

At the controls for the three and a half hour flight was Boeing Chief Pilot Mark Feuerstein, accompanied by Captain Tom Imrich. Delayed by two hours due to bad weather in the morning, the new 'Jumbo' took to the air at 12:39 local time. "It was a real privilege to be at the controls of this great airplane on its first flight, representing the thousands of folks who made today possible," said Feuerstein. "The airplane performed as expected and handled just like a 747-400."

The flight marked the beginning of a planned 1,600 flight-hour test programme with type certification scheduled for the fourth quarter of this year when the first aircraft will be repainted in the colours of launch customer Cargolux for delivery.

It was in November 2005 that Boeing announced the launch of the B747-8. A modest stretch of the '400, it includes many of the innovative technologies being incorporated into the 787 Dreamliner – in fact, the designation B747-8 was a deliberate choice in order to highlight the technology connection with the 787.

The aircraft is 8ft 4in (5.6m) longer than the B747-400 and the passenger version, dubbed the Intercontinental, is being marketed as a 400- to 500-seat airliner positioned between the B777 and the A380. It has space for 51 more seats than the -400, offering accommodation for 467 passengers in a typical three-class configuration.

Boeing claims the latest variant will offer seat-mile costs approximately 11% lower than the -400, a trip-cost reduction of 19%, and a seat-mile cost reduction

ABOVE: *787 ZA003 in the climatic chamber at McKinley Climatic Laboratory, located within Eglin Air Force Base in Florida.*

BELOW: *ZA002 takes to the air on December 22, 2009. On June 16 the test fleet passed the 1,000 hour milestone*

ORDER HOTLINE 01895 231 707 WWW.AVIATIONRETAILDIRECT.COM

ARD
AviationRetailDirect.com

Model aircraft of all sizes for everyone!

Airliner display models, souvenirs, toys, books. Military aircraft models.

✈ Airbus A380 ✈ Boeing 787 ✈ Airbus A400M ✈ Concorde ✈ Spitfire/Lancaster/Hurricane

Visit our retail marquees at Farnborough Air Show

- next to Hall 1 on Lincoln Road

- and on the static aircraft display

Aviation Retail Direct, 10 Sutton Court Rd., Hillingdon, Middx. UB10 9HP, Tel: 01895 231707, Fax: 01895 236707
Aviation Retail Direct, The Heathrow Academy, Newall Road, Heathrow Airport 'North Side', Middlesex TW6 2AP

We take you all over the world, all year round

White Airways is part of the OMNI Aviation Group (the largest private Portuguese group in aviation industry, which counts with a global fleet of more than 55 aircrafts and is present in 4 countries).

White is an EU OPS carrier, EASA certified and FAA approved. It is an IATA member, IOSA registered and has its system of quality certified according to NP EN ISO 9001:2008.

White operates according to the needs and expectations of its clients offering flexible and innovative solutions with high standards of quality and safety.

Services:
Charter
ACMI
Wetlease

Fleet:
2 Airbus 310
2 Airbus 320
2 Airbus 319CJ (VIP Configuration)

Contacts:
sales@flywhite.com | +351 912 310 330 | www.flywhite.com

Part of group
omni Aviation

SGS IATA | Member

Boeing's first 747-8F flies, accompanied by a company chase T-33 aircraft on February 8.

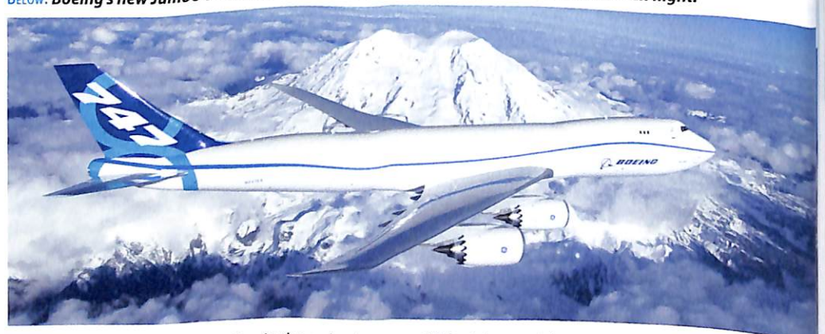
of more than 4% compared to the A380. It will have a range of around 8,000 nautical miles (14,815km), meaning that it could offer non-stop connections on many of the world's major routes. With a maximum structural payload capacity of 140 tonnes (154 tons), the B747-8 Freighter has 16% more cargo volume than its predecessor. The additional 4,245cu ft (120m³) of volume allows it to accommodate four more main-deck pallets, as well as three further lower-hold ones.

Boeing has secured 108 firm orders for the B747-8, mostly for the freighter version. In fact, it has only two airline customers for the Intercontinental, with Lufthansa ordering 20 examples in December 2006 and Korean Air purchasing five in December 2009 – a further seven orders listed in Boeing's order book are for VIP variants.

Eight customers have selected the freighter: Atlas Air (12), Cargolux Airlines (13), Cathay Pacific Airways (10), Dubai Aerospace Enterprise (15), Guggenheim Aviation Partners (2), Korean Air (5), Nippon Cargo Airlines (14) and Volga-Dnepr Airlines (5).

On March 15, 2010 Boeing's test fleet had possibly never been busier with the first flight of the second 747-8F close on the heels of the fourth 787. Coded RC 522, the second 747-8F took off from Boeing's Paine Field for a two and a half hour flight, landing at Boeing Field in Seattle after reaching an altitude of 27,000ft (8,230m) and an airspeed of 240 knots. Just three days later Boeing's third and final development aircraft, RC 521, joined the programme. RC 521 will concentrate on fuel-mileage testing in the early phases – the 747-8 Freighter flight-test programme calls for all three aircraft to perform approximately 3,700 hours of testing, both on the ground and in the air.

ABOVE: *The third 747-8F, RC 521, flies for the first time on March 17.*
BELOW: *Boeing's new Jumbo casts a shadow over western Washington State on its maiden flight.*



On April 19 RC 521 moved to Palmdale in California; "Palmdale provides an excellent test environment said Andy Hammer, 747 Test Programme Manager. "allows us to take full advantage of one of the world premier experimental test flight facilities and th excellent weather conditions to meet our flight-te requirements on the road to obtaining our amende type certification." The three test aircraft will be base at Palmdale for the majority of the scheduled flight-te programme.

Boeing began assembly of the first 747- Intercontinental passenger airliner at its factory Everett on May 10. Lufthansa was the first airline order the passenger version of the 747-8 signing for and securing purchase rights for an additional 20.

"We are very pleased to see that the productio on the 747-8 Intercontinental has begun," said Nic Buchholz, Senior Vice President, Corporate Fleet Deutsche Lufthansa AG. As we went to press Boeing 787 was planned to make its Farnborough debut thi year, maybe the Intercontinental will be the company star of the 2012 airshow.

ZA003 is the fourth 787 to fly, taking to the air on March 14.

Mr Blue Sky!

Flt Lt Leon Creese, RAF King Air display pilot, reveals the techniques and creativity that go into planning the demonstrations that exhilarate flyers and thrill audiences.

The King Air B200 has been in service with the Royal Air Force's No.45(R) Squadron at RAF Cranwell in Lincolnshire as a multi-engine pilot trainer since November 2003. IMAGE COURTESY LEON CREESE

WHY DO WE DO IT?

There are several answers to that question, but by far the most important is recruiting. You may be surprised to learn that, despite the opportunity to operate some of the most capable military hardware in challenging circumstances across the globe, the air force actually struggles to attract a sufficient number of high-calibre candidates into its selection process. Airshows give the RAF high profile exposure to large audiences, many of whom already have an interest in aviation. As pilots, we make a considerable effort to engage with the public, describing the job, service life, and answering their questions. Without doubt, childhood visits to Farnborough led to my choice of career, and I am delighted to be able to play a small part in inspiring a new generation of youngsters to consider a career in the RAF.

While the King Air is designed to be flown by a single pilot, much of the training carried out on 45(Reserve) Squadron is intended to give student pilots a thorough grounding in multi-crew operating techniques. The principles of Crew Resource Management remain very much in evidence in the King Air display with the workload being shared between the two experienced Qualified Flying Instructors. While I am responsible for the overall conduct of the flight and physically handling the aircraft, my co-pilot colleague closely monitors the engine instruments and with continual reference to the flight instruments, he gives me a continuous commentary of our height and speed, as well as assisting with lookout and positioning calls. For those of you with air band radios, it'll be his voice that you'll most likely hear talking to ATC.

DESIGNING THE DISPLAY

Before we started designing the RAF's first King Air display back in 2008, I had attended numerous airshows with static display aircraft. I'd also completed a season dropping the RAF Falcons parachute display team when I flew the Hercules and had attended many airshows as a spectator. Therefore, I'd had plenty of opportunities to consider what looked good in a display, and what didn't work so well. A set of requirements formed the framework within which we would design the display: it had to be safe, entertaining and dynamic – in that order. It would be compact and aesthetically pleasing. Technical difficulty did not feature in the list – I've seen too many displays spoilt by difficult manoeuvres that didn't quite work on the day, and even if they had, the achievement would not have been appreciated by the vast majority of the audience. Also, the first priority was that it had to be safe; there was no way we would get

Mr Blue Sky in his element. IMAGE COURTESY LEON CREESE

BEWARE THE WIND

Ask any display pilot to describe the worst display conditions and he'll describe low cloud, poor visibility and a strong on-crowd wind. The cloud and visibility speak for themselves, but the effect of wind is perhaps harder to comprehend. Consider you're at crowd centre watching a King Air flying along the display line from left to right. Now, let's say you can feel a fresh breeze on your face; it might be 20 knots (23 mph). The wind strength increases with height, so the aircraft might experience 30 knots (35 mph). As the aircraft reaches crowd centre, it starts a steep turn to the left away from you with a steady bank angle and speed. After thirty seconds, it will have turned through 360°, so that it is now flying along the display line again – only it's not. In those thirty seconds, the King Air will have drifted a quarter of a mile towards you! In real terms, that would take it from the display line, safely 230m in front of you, to some 200m behind you. This, of course, is not allowed, so the pilot must do something to counter the drift. In simple terms, he'll aim to keep the aircraft flying into the wind longer than it will fly downwind. He can achieve this in several ways. First, he could adjust the rate of turn by changing the bank angle – this is the technique used in normal non-display flying. The downside to this technique is that the changing bank angle may be quite apparent to the audience – something the pilot might wish to avoid. Another technique is to use some rudder to oppose the turn, causing the fuselage and vertical tail surfaces to produce lift, allowing the pilot to maintain a constant bank angle but reduce the backpressure required to stay level, thereby reducing the rate of turn for the into wind portion. He would reverse the rudder application to increase the turn rate for the second half of the turn. This second technique is favoured in competition aerobatics where precision rules. In the King Air, we use a little of both techniques.

approval to perform our new display for the public if there were any doubts about our ability to complete it safely.

I sought to identify the attributes of the King Air that we should exploit – unlike a fighter, it isn't noisy, it doesn't generate flames from its back end, it doesn't go particularly fast, and regulations prevent us from going upside down. So what's left? I thought we should capitalise on the short take-off performance and rapid acceleration, its low speed control authority and manoeuvrability, its propeller drag enabling very steep approach, and its ability to stop quickly an reverse on the runway. It later became apparent tha the lack of noise made it well-suited to a continuou commentary and musical accompaniment.

Its multi-engine transport aircraft design ensure that, should we lose an engine just after take-off, w have sufficient power from the remaining engine t continue climbing to a safe height. In twin-engin aircraft, this simply means the two engines togeth

Seven King Airs are named after aircraft that have served with the unit over the years: Assyrian, Aurora, Golden Gain, Morpheus, Stormcock, Vagabond and Valkyrie. Three more recent aircraft have been named Daedalus, Hercules and Nimrod. Here ZK452/'Golden Gain' taxis in at RAF Waddington. KEY – GARY PARSONS

provide twice as much power as the aircraft needs – that is good for display flying. Unburdened by the rules that require some aircraft to conduct an inverted flight check before commencing their display – that's why Tucano and Hawk, for example, commence their display already airborne – it seemed clear that we should begin the King Air display from brakes-off, with a maximum performance take-off. The King Air accelerates from 0 to 100 knots (115 mph) in about 12 seconds – not bad for a five-tonne truck! Once the landing gear is up, it

ABOVE: ***Kings Airs can often be seen low-level training in the Welsh hills.*** IMAGE COURTESY MORLEY LESTER
BELOW: ***Flt Lt Leon Creese.*** CROWN COPYRIGHT/MOD

A King Air flies over the College building at RAF Cranwell. On entry into service all aircraft were registered with the Civil Aviation Authority, but since then most have been transferred to the military register. KEY COLLECTION

continues very quickly to about 140 knots (160 mph), by which speed the flying controls are very effective, giving us the opportunity to surprise the crowd with a snappy turn away as we accelerate for the first wingover. I wanted the first pitch up to occur as we flew away from the crowd as this presents the aircraft in plan form and exaggerates the angle of climb to nearly vertical – in reality, we never exceed 45° nose-up. This steep climb-out provides the second surprise, hopefully convincing the audience that this little 'executive transport aircraft' has more to offer than they might have expected. The speed then decreases towards the display minimum speed, resulting in a small turn radius. I exploit this throughout the display to keep us as close to the crowd as possible. We descend quickly back towards the display line and our minimum permitted height before I pitch up for the next manoeuvre.

Transport aircraft are not designed for knife-edge flight (that is straight and level flight with a large bank angle), but I wanted to show off the top surface of the aircraft along the full length of the crowd line (any aviation photographer will tell you that for most types, the topside is more pleasing to look at than the belly). Straying away from conventional display manoeuvres, I recognised that the speed and inertia of the King Air are ideal for what has become known as the 'parabolic knife-edge pass', although it is also regularly called 'the rainbow', 'the bridge' or 'the banana'! For most venues, this gently curving rainbow-shaped pass neatly fills the full length of the display line.

A climbing turn topping out at 2,500ft positions us for the next manoeuvre, a steep descent towards crowd centre once again presenting the aircraft in plan form, again steepening the appearance of the descent. The minimum in-flight power setting – Flight Idle – makes the propellers act like windmills, causing lots of drag, preventing the aircraft from accelerating too quickly, which in turn allows a late recovery to level flight and a tight turn away before reaching the display line. A wingover positions us on the B-axis, flying straight towards the crowd at crowd centre. As late as I can safely leave it, I pull up into another wingover, this time with our underside to the crowd and apparently almost overhead. The lack of a horizontal reference in the spectator's field of view lends an additional element of dynamism to this manoeuvre in which the aircraft appears almost inverted.

Next follows a series of rapid reversals or S-turns –

Leon gets the King Air into a display – it's not often the sun shines on the underside of the aircraft! IMAGE COURTESY MARTIN EAMES

these are new for 2010, and I hope will show off the roll-rate, which is impressive for this type of aircraft. The small turn radius allows us to complete four reversals within the length of the crowd line.

A high-speed pass, flown close to the aircraft's limiting speed of 259 knots (300 mph), is followed by a break away from the crowd and a climbing turn back to line up with the runway ready for the final approach. In the climb, we lower the landing gear and flaps and the speed decays once again to its safe minimum. With the flaps set fully down for maximum drag and Flight Idle power set, we commence our very steep approach. The plan is for us to stop just after the display datum. Before take-off, I calculate our stopping distance and, therefore, our touchdown point. These will vary with the weight of the aircraft, the slope of the runway, the headwind component, and whether the runway is dry or wet. Throughout the display, I assess the actual effect of the wind and adjust our tip-in point accordingly; there is no electronic gadget to assist.

As we touch down on the runway, I quickly lift the power levers (we don't call them throttles) up and back over a step to Ground Idle, and as the co-pilot closely monitors the engine instruments, I lift the levers up and back again into the maximum reverse thrust position. I apply the brakes as necessary to bring the aircraft to a stop just after passing the datum. As the aircraft stops, I ensure we both have our toes clear of the brakes and, with maximum reverse thrust still selected, the aircraft starts to go backwards – if I were to apply the brakes while reversing, the nose would lift and the tail could strike the ground.

MUSIC

Displays are flown to all kinds of music: some work very well while others seem very oddly matched. I gave a lot of thought to whether it would be appropriate to display a military aircraft to music, and decided that while we are there to represent and recruit, we are also there to entertain. I sought a suitably upbeat tune that would be immediately recognisable and had no political connotations. Of course, it had to complement the display, so I recorded a computer simulation of the display and played it back repeatedly as I worked my way through my music collection. I settled on *Mr Blue Sky* by the Electric Light Orchestra, which seemed right in so many ways. Throughout 2008, I recommended it to commentary teams, some of whom used it to complement their commentary. By the end of the season, audiences were complaining when it was not used! By popular demand, it seems to have stuck.

THE SHOW GOES ON...

Once the aircraft has been 'put to bed', we spend as much time as possible meeting the public. If you'd like to know more about what we do, come and talk to us. Remember we attend airshows for you! You can learn more about careers in the Royal Air Force at www.raf.mod.uk where you'll also find links to all the RAF display teams.

The King Air replaced the Jetstream (background) in the multi-engine training role in April 2004. KEY COLLECTION

AirNav RadarBox-3D

AirNav Systems
The Most Trusted Name In Flight Tracking

Virtual Radar On Your PC!

- Designed By Professional Pilots
- Chosen By Boeing
- Used In Space & By The BBC

RadarBox is a virtual radar system that you run live on your PC. The package includes the software, the receiver USB-powered module and the antenna. Just plug it into PC and see live aircraft tracking up to 150 mile radius. You get automatic library pictures of aircraft type and each aircraft is tagged with flight data including type, flight number, height, speed, origin, destination etc. Select filters to just monitor certain airlines or types. Zoom in to runway level or zoom out to country-wide coverage. Click the internet connection and you immediately share world data with other users enabling you to track aircraft world-wide. And if you purchase the 3D version you get Google Earth mapping and adjustable 3D viewing. RadarBox is reliable, stable, and unlike other systems, you get everything in the box.

WATERS & STANTON

To Order Call: 01702 206835 Visit Us At;
W&S, 22 Main Rd, Hockley, Essex, SS5 4QS.
Full Details & Web Orders: www.wsplc.com

We accept: MasterCard Maestro VISA AMERICAN EXPRESS DELTA

RadarBox-3D £489
RadarBox-Pro £399

Campbell Aero Classics
Classic Leather Hard Shell Flying Helmets

Stunning Classical Look
Outstanding Noise Attenuation
Superb Custom Fit Comfort
Premium Kevlar Protection
The choice of today's aviators worldwide.

order today...
Ivan and Sandy Campbell
ivan@campbellaeroclassics.com ph: +64 (0) 3 312 8008
www.campbellaeroclassics.com © 2009 Campbell Aero Classics

RENAISSANCE®
LONDON HEATHROW HOTEL

Discoverers'
Flight Simulator Experience

This is the ultimate experience for those that get a thrill from a challenge!

The package is for two people and includes:

*One night's stay in a Club bedroom with guaranteed airport view and continental breakfast in the Club Lounge
*Complimentary transport on BA bus to and from Cranebank
*Flight Simulator Experience on Boeing 737
*Overnight parking at the hotel

One Hour Simulator Rates:	Three Hour Simulator Rates:
Weekday £399.00	Weekday £975.00
Weekend £389.00	Weekend £950.00

Weekend is Friday, Saturday & Sunday nights. All rates are exclusive of VAT. Subject to availability.

To book or make an inquiry call Internal Reservations on 020 8897 6363 and quote FSP10

Bath Road, Hounslow, Middlesex TW6 2AQ
Tel: +44 (0)20 8897 6363 Fax: +44 (0)20 8897 1113

Lightning Shock

AIR International's Editor Mark Ayton and key.aero's Editor Gary Parsons report on the F-35's flight test programme progress.

MAIN IMAGE: ***The F-35A prototype, AA-1, above the desert during a test flight. This aircraft was retired in December 2009 after 91 sorties and was used as a live weapons target.*** ALL IMAGES LOCKHEED MARTIN UNLESS CREDITED OTHERWISE

When Lockheed Martin test pilot David 'Doc' Nelson climbed into his jet in the flight test barn at Fort Worth on November 14, 2009, his mission that day was significant – this was to be the maiden flight of the first optimised conventional take-off and landing (CTOL) F-35A Lightning II, AF-01.

Lockheed Martin uses the term 'optimised' to distinguish between the original prototype F-35A AA-01, which was built to the original design specification and gross weight, and subsequent aircraft that incorporate design changes made to reduce the aircraft's weight. AF-01 incorporates parts that have been redesigned to provide additional strength or in other cases been made lighter as derived from the test programme of AA-01.

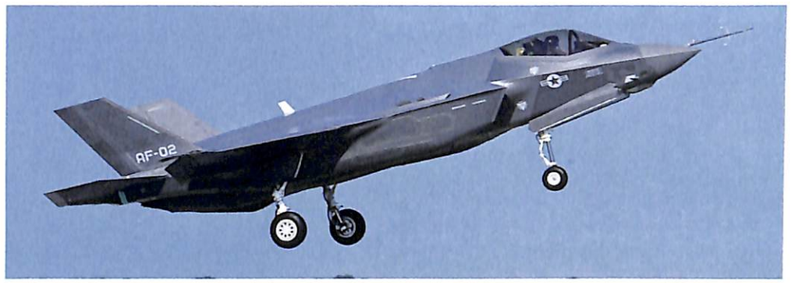
Doc took off from Lockheed Martin's plant at Naval Air Station (NAS) Fort Worth Joint Reserve Base at 13:34hrs local time. During the 89-minute test flight Doc flew to an altitude of 20,000ft (6,096m), achieved an airspeed of Mach 0.6, retracted and lowered the landing gear, performed 360° rolls and flew at 20° angle of attack.

Commenting on the flight, Doug Pearson, Lockheed Martin Vice President for F-35 Test and Verification, said: "AF-01 is one of the most important aircraft in our test fleet because knowledge gained from its use expanding the flight envelope will benefit the other two variants – and every F-35 ever built."

The first flight of AF-01 is positive news for Lockheed Martin and its flight test team, but the aircraft should have taken to the air five months earlier. According to Lockheed Martin's revised schedule of May 2008, 13 aircraft were to have flown by October 2009. In reality AF-01 is only the fourth F-35 aircraft to fly since the contract was awarded in late 2001. AF-01 has joined AA-01 (now grounded and undergoing destructive tests at Naval Air Weapons Station China Lake, California) and three F-35Bs, BF-01, BF-02 and BF-03 short take-off and vertical landing (STOVL) variants currently in flight test.

JUMPING FOR JOY

As Doc Nelson landed at 15:03hrs, his colleague Jon



ABOVE: ***The second F-35A, AF-02, joined the test fleet on April 21, 2010.***
BELOW: ***The first definitive F-35A, AF-01, first flew on November 13, 2009 enabling the original prototype AA-1 to be retired.***

Beesley, Lockheed Martin's F-35 Chief Test Pilot, was preparing for another notable flight that weekend. On November 15, Beesley flew F-35B BF-01 to NAS Patuxent River, Maryland, landing there at 12:46hrs local time. The move follows a series of hover pit trials at Lockheed Martin's facility at Fort Worth. Patuxent River, known as 'Pax River', is the home of Naval Air Systems Command (NAVAIR) and the primary test site for the F-35B STOVL variant.

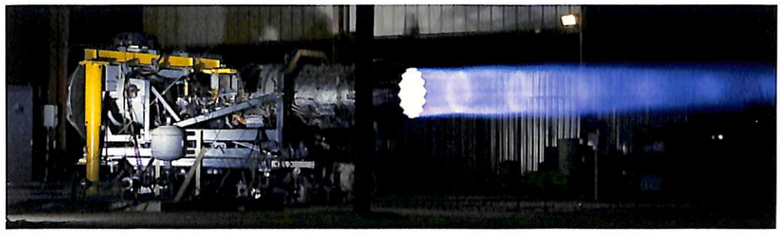
During the hover pit trials, BF-01 was anchored on top of a metal grid about 15ft (4.57m) off the floor of the pit, to enable the aircraft to simulate free-air flight and to measure the output of the propulsion system comprising the engine, variable nozzle, lift fan and vanes. BF-01 is now assigned to the F-35 division of Air Test and Evaluation Squadron 23 (VX-23) 'Salty Dogs', one of NAVAIR's resident units at Pax River and part of the F-35 Integrated Test Team.

Initially test pilots will complete shorter take-off runs and slow the aircraft down during landing so that lift from the wing can be transitioned to the aircraft. This transition phase is critical before an actual vertical landing. Trials will also involve flight deck operations using a purpose-built ramp to replicate a 'ski-jump' equipped aircraft carrier, and further testing will include flying with different weight loads, ordnance payloads, and work-ups to shipboard operations.

Commenting on the arrival of BF-01 at Pax River, Lt General George Trautman III, US Marine Corps Deputy Commandant for Aviation, emphasised the need to make up the delays in flight-testing of the F-35. "I'm anxious to have our engineers, our test pilots, and our operators get their hands on this jet, and then see what we can do to turn test points and sorties at a rapid rate during the coming months."

BF-01 is the first of five F-35Bs due to be assigned to Pax River and is the first Lightning II to be sustained by the F-35 Autonomic Logistics Information System (ALIS). It will be monitored by the Lockheed Martin F-35 Sustainment Operations Centre at Fort Worth – ALIS will be used to support the worldwide fleet as soon as the type enters service.

Two follow-on aircraft, BF-02 and BF-03, were delivered in January and February respectively, with the first mission systems-equipped F-35B, BF-04, arriving in April. BF-03 is being used to evaluate vehicle systems and expand the aircraft's aerodynamic and structural-



ABOVE: ***One of two engines currently being developed for the F-35, Pratt & Whitney's F135 undergoes a full-power static test.***
BELOW: ***The X-35 prototype that won the fly-off competition against Boeing's X-32.***

loads envelope as well as weapons testing, while BF-04 is equipped with an avionics suite more representative of the final production version, incorporating the Northrop Grumman AN/APG-81 Active Electronically Scanned Array (AESA) radar; the Lockheed Martin Electro-Optical Targeting System (EOTS); the Northrop Grumman Electro-Optical Distributed Aperture System (EO-DAS); a BAE Systems Electronic Warfare (EW) system; a VSI Helmet Mounted Display System (HMDS); the Northrop Grumman Integrated Communication, Navigation & Identification (ICNI) friend-or-foe identification; the Lockheed Martin Integrated Core Processor (ICP) with Block 0.5 functionality; a Honeywell Inertial Navigation System and Raytheon Global Positioning System. The new avionics package has already undergone more than 100,000 hours of laboratory testing and flight testing in the Cooperative Avionics Test Bed (CATB), a highly-modified Boeing 737 incorporating an F-35 cockpit layout.

PRODUCTION PROGRESS

During *AIR International*'s visit to Fort Worth in late 2009, there were 31 Low Rate Initial Production (LRIP) aircraft in various stages of assembly, including all 12 on the final assembly mating line: the US Navy's first F-35C carrier variant CF-01, one F-35B (BF-05) and three F-35As; AF-03 and aircraft from LRIP 1 that are destined for the training unit at Eglin Air Force Base in Florida. CF-01 was back on the line despite the July 28, 2009 'roll-out' As the first of its kind, the aircraft was due to go out to the fuel barn in January to undergo fuel system calibration work. Lockheed Martin hopes to undertake its maiden flight in the first half of 2010, but had not done so by the time this article went to press.

Lockheed Martin is banking on its continuously moving mating line to move at 50 inches (1.27m) visited the line it was static, but would soon move at inches (100mm) per hour, according to one compan employee.

To preserve its stealth capabilities, the F-35 has been designed with internal weapons bays.

An F-35 cockpit has been fully flight tested in this Boeing 737 test aircraft owned by Lockheed Martin.

FIRST VERTICAL LANDING

March 18: F-35B BF-01 made the first controlled vertical landing at Naval Air Station in Patuxent River, Maryland, USA. "Today's vertical landing onto a 95ft square pad showed that we have the thrust and the control to manoeuvre accurately both in free air and in the descent through ground effect," said F-35 Lead Short Take-off and Vertical Landing pilot, Graham Tomlinson, a retired Royal Air Force fighter pilot and a BAE Systems employee since 1986. Tomlinson positioned the aircraft 150ft above the airfield, where the F-35 remained in the hover for approximately one minute before descending to the pad. "The low workload in the cockpit contrasted sharply with legacy STOVL platforms," he added, presumably referring to the Harrier and AV-8B.

FULL-SCALE DROP TESTS

In mid-November Vought Aircraft Industries in Dalla Texas, took delivery of F-35C carrier variant CG-01 fro Lockheed Martin to perform full-scale drop testin Test objectives include structural verification of th landing gear and airframe in accordance with US Nav requirements for carrier landing operations. CG-01 i fitted with special drop test fixtures, test systems an instrumentation to measure loads, stresses, deflection and accelerations at various locations on the landin gear and airframe.

The tests were successfully carried out between Marc and April, and included dropping CG-01 95 inches at 2 feet per second, with an 8.8 degree pitch, two degre roll, and 133 knot wheel speed, simulating a carrier deck landing. Nearly 500 sensors were monitored, wit 2,500 points collected per second.

TYPES OF AIRCRAFT

To some eyes, each F-35 aircraft rolling off the Fort Wort production line looks much the same, but there are ir fact three types of aircraft. First there are those usec as static and durability test articles, and then two kind that fly: flight science aircraft and mission system aircraft Lockheed Martin built six ground-based test articles; one static and one fatigue of each A, B and C variant.

Flight science aircraft carry instrumentation fo measuring parameters such as structural loads and are used for expanding the flight envelope. Mission system aircraft are fitted with Communications, Navigation and Identification (CNI), Defensive Aids Systems (DAS) Electro-optical Targeting System (EOTS), Electronic Warfare (EW) packages and the APG-81 Active Electronically Scanned Array (AESA) radar and carry instrumentation to measure systems performance parameters such as temperature and vibrations.

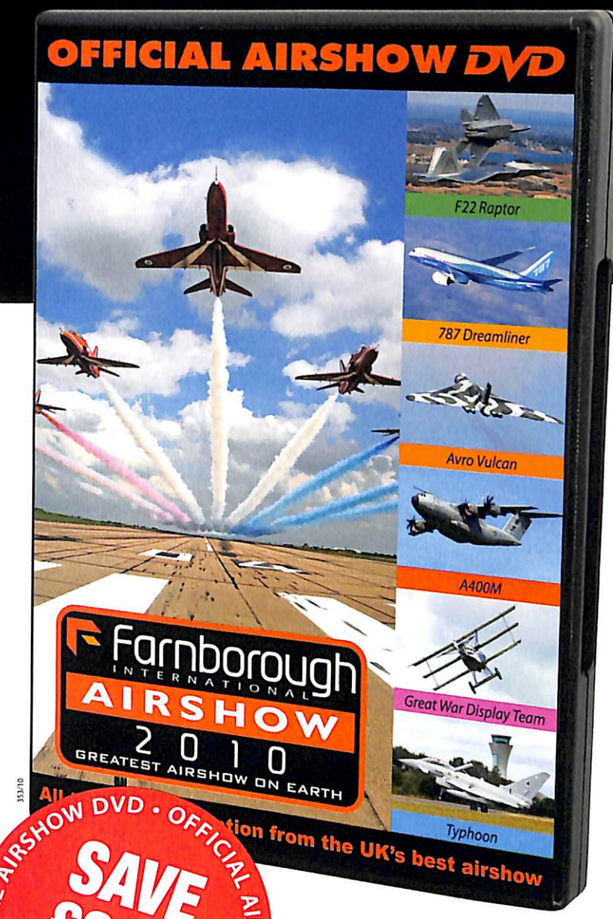
OUT OF SHAPE?

As this gargantuan programme moves slowly forward, Lockheed Martin remains behind schedule and over budget. So much in fact, that the latest Pentagon appraisal of the programme cites that two more years and billions of additional dollars are required to complete the F-35's development.

In January a report issued by the US Defense Operational Test and Evaluation Directorate (DOT&E) poured more fuel on the fire of concern over slipping

OFFICIAL AIRSHOW DVD

Greatest Airshow on Earth!



Farnborough INTERNATIONAL AIRSHOW
19 - 25 July - 2010

Welcome to *Farnborough International Airshow 2010,* the most prestigious air and trade show in the world! This event features one of the best aerial displays in aviation history!

Included in this programme is the first ever airshow appearance by the hottest commercial aircraft in the world, the Boeing 787 Dreamliner. Airbus once again bring their massive Super Jumbo A380, the world's largest commercial airliner.

A stunning military line-up features Airbus' first military aircraft, the A400M and, not to be outdone, the USAF and RAF show off their power in the form of the F-22 Raptor, the F/A-18 Super Hornet, the Eurofighter Typhoon and the spectacular Red Arrows.

Warbirds also feature by way of the Great War Display Team, amongst many other historic aircraft!

OFFICIAL AIRSHOW DVD • OFFICIAL AIRSHOW DVD
SAVE £2.00
RRP £14.99

Pre-order your copy now!
Just £12.99 with FREE P&P†

Available from Showground Kiosks and Halls 1, 2 and 3

Alternatively order online at www.keypublishing.com or Call 01780 480404 UK or +44 1780 480 404 Overseas

†Pre-order price available until 30 September 2010. Delivery from 31 August 2010. FREE P&P UK and BFPO only. Rest of World £1

BF-01 is shadowed by an F/A-18 chase aircraft on a sortie from NAS Patuxent River in Maryland where the majority of the F-35 programme is being conducted.

RAF PILOT FLIES F-35

Squadron Leader Steve Long. CROWN COPYRIGHT/MOD

January 26: Squadron Leader Steve Long, a Royal Air Force serviceman became the first active-duty pilot from the UK to take the controls of the F-35B Lightning II Joint Strike Fighter. Sqn Ldr Long flew BF-02 on a sortie from Naval Air Station Patuxent River on its 18th test flight, taking the aircraft to 20,000ft on the 80 minute flight. "Flying the F-35 was exactly like the simulators that I've been flying for over 18 months," he said. He is currently on an exchange programme with the US Marine Corps flying the F/A-18C. British pilots and ground crew will soon start initial training at Eglin Air Force Base in Texas in readiness to receive the first production aircraft in 2011.

deadlines and development timescales. The DOT&E reports directly to the US Defense Secretary, Robert Gates and is responsible for reviewing and analysing the results of OT&E for each major Department of Defense (DoD) acquisition programme.

Dr Michael Gilmore, the Director DOT&E said that "the verification and flight test [programme] did not reach the tempo planned for FY09 due primarily to late deliveries of the remaining ten (of 13) System Design Demonstration (SDD) flight test aircraft." He added that only 16 of a planned 168 flight test sorties were accomplished.

According to Dr Gilmore, the deployment plans of the DoD for the F-35 are at "substantial risk" given the current pace of the programme and that completion of initial OT&E capability could only occur in early to mid-2016 provided the associated extension of SDD is supported with "additional flight test aircraft, timely delivery of effective software, and an adequate pace of testing is maintained." Dr Gilmore is also critical of the clarity of what constitutes initial operational capability, stating that the mission capability of the low-rate initial production (LRIP) aircraft and support systems is "unclear."

The 'weight loss' programme of recent years has also brought increased risk, he said, as "recent removal of shut-off fuses for engine 'fueldraulics' lines, coupled with the prior removal of dry bay fire extinguishers, has increased the likelihood of aircraft combat losses from ballistic threat induced fires."

This was followed in March by a report from the US Government Accountability Office (GAO), saying that a "new, comprehensive, and independent assessment of the costs and schedule" should be made by the Department of Defense (DoD) before committing to production decisions.

The report, entitled 'Additional Costs and Delays Risk Not Meeting Warfighter Requirements on Time' said that the total estimated costs had increased by $46 billion and the development timeline extended by two years over that agreed just three years before. Total cost of the programme was then estimated at $323 billion through to 2035, it being the DoD's "most costly and longest acquisition programme." Life-cycle costs for operating, sustaining, and maintaining JSF fleets were estimated at $764 billion, substantially higher than earlier estimates and also more than legacy aircraft the type will replace, said the GAO.

It also criticised the pace of the flight test schedule saying manufacturing the test aircraft "continues to take more time, money, and effort than budgeted." In summary the GAO recommended that together with a review of costs, likely to be forced through a breach of the 'Nunn-McCurdy' rule within Congress, that the date for achieving initial operational capabilities (IOC) must be delayed or the military services "will have to accept less initial capability" and defer desired requirements to future upgrade programmes. It particularly pointed to the US Marine Corps' stated intent to achieve IOC in 2012 when production aircraft are unlikely to be delivered until 2013. As an indication of the USMC's resolve, the first active-duty F-35 squadron formally stood-up as the US Marine Corps (USMC) F-35B Lightning II training squadron, Marine Fighter Attack Training Squadron 501 (VMFAT 501) on April 2.

VFMAT 501 'Warlords' is embedded in an Air Force

The vertical landing flaps and doors of the STOVL F-35B are clearly illustrated in this image of BF-01 during flight testing.

wing, being part of the 33rd Fighter Wing based at Eglin Air Force Base in Florida, a first for a USMC squadron. The unit was redesignated from VMFAT 451, a 13-year retired squadron that was reactivated on April 1. The squadron is hoping to receive its first F-35B before the end of the year, depending upon Lockheed Martin's development programme, and the USMC still hopes to have eight initial cadre and two operational test pilots trained by the end of 2011.

The US Navy's F-35C variant was also facing a redesign, said the report, as "significant design modifications to the keel web, a key structural joint to enable catapult take-offs" was required.

With its recommendations for F-35, the GAO said that contingency plans for 'legacy' aircraft (such as F/A-18C) needed to be developed so that a properly resourced strategy is in place to fill capability and capacity gaps until the F-35 achieves IOC in the respective services.

On March 25 the Pentagon officially notified US Congress of the F-35 programme's breach of cost limits under the 'Nunn-McCurdy' legislation, requiring a complete review of the whole programme.

The Nunn–McCurdy Amendment or Nunn–McCurdy Provision was introduced into US legislation in 1982 by Senator Sam Nunn and Congressman Dave McCurdy and is designed to curtail cost growth in weapons procurement programmes. The amendment requires programmes with cost escalations of more than 25% to be cancelled unless the Secretary of Defense can prove it is essential to national security and that no viable option is available. There is little likelihood of F-35 being cancelled, as Secretary of Defense Robert Gates will undoubtedly argue there is no alternative to the multi-billion dollar fighter. What is likely is that procurement plans will be reviewed with fewer fighters bought for the US forces and a possible rationalisation of the versions planned, with the F-35B and F-35C both experiencing technical difficulties. This is the second time that the F-35 faces a Nunn-McCurdy breach – the first was in 2005 when the project was re-baselined after several redesigns forced through the 'weight-loss' programme.

ABOVE: ***The first F-35C, CF-01, is rolled out for the US Navy in August 2009. It flew for the first time on June 6.*** BELOW: ***An F-35 slides up to a KC-135R during a test sortie.***

Test vehicle CG-01 is being used by sub-contractor Vought to measure simulated carrier landings by being dropped from various heights. VOUGHT IMAGE

ENGINES — ONE OR TWO?

A constant debate in Congress is whether two different engines should be funded for the F-35 – the Pratt & Whitney-led F135 and the General Electric-led F136. In US President Obama's budget statement in March, the battle lines were once again drawn.

With Congress having battled successfully to keep the General Electric and Rolls-Royce F136 Alternative Engine Program (AEP) alive in the 2010 Defense Appropriations Bill, Obama's defence budget proposals for 2011 will once again try to kill the F136 through "prioritising resources by ending or reducing several programmes, including the C-17 aircraft and the Joint Strike Fighter Alternate Engine."

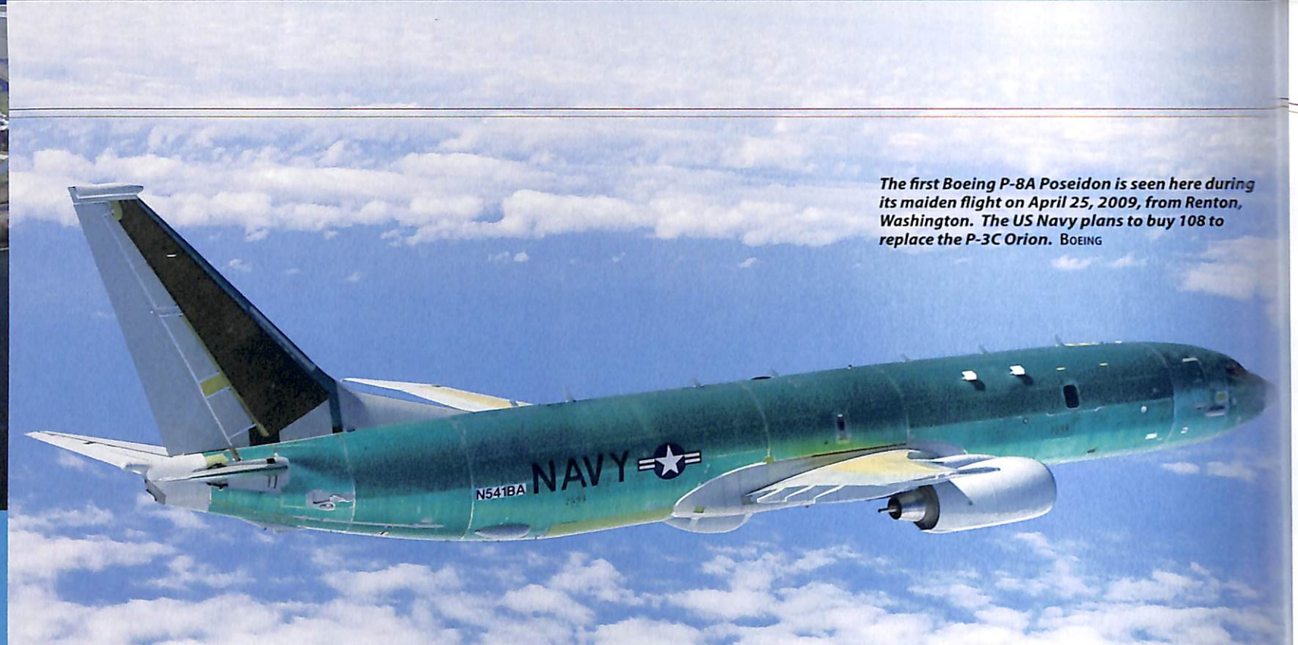
The AEP has been a political battleground for the last few years, and the Obama Administration says "the reasons for cancelling the AEP in 2007 remain valid today." It believes a second engine "is unnecessary - financial benefits, such as savings from competition, have been assessed to be small, if they exist at all".

A COMPLEX PROCESS

Considering the magnitude of the task, cost overruns are perhaps unsurprising. Concurrent development of three different variants of the most complex fighter aircraft, set to be built on a continuous moving production line at one plant, supplied by subcontractors based around the world, is not a simple task.

Lockheed Martin provided statistics to show the scope of the system design and development task of the F-35. Two in particular show the kinds of numbers involved in F-35: to date, 48,704 build to package (BTP) line items have been finished, and 55% of the projected changes required to BTPs as part of the redesign are complete. And what about software? Everything that functions on the jet is controlled by computer, for which there are 18.8 million lines of code, 78% of which has been tested and released.

With an estimated total cost in excess of $300 billion for thousands of aircraft supplied to multiple air arms around the world, the entire F-35 programme is by any stretch of the imagination ambitious. The current problems appear to match that ambition. Lockheed Martin's goal is to build one F-35 every day. If it and its programme partners reach that milestone, future visits to the Fort Worth production line will be a sight worth seeing.



The first Boeing P-8A Poseidon is seen here during its maiden flight on April 25, 2009, from Renton, Washington. The US Navy plans to buy 108 to replace the P-3C Orion. BOEING

MILESTONES

AirForces Monthly's News Editor, Dave Allport, lists the major orders, events and developments in the aerospace industry since the last Farnborough Air Show in 2008.

2008

July 7: The first pre-production Alenia Aermacchi M-346 advanced jet trainer made its maiden flight.

July 11: New start-up carrier FlyDubai announced a $3.74 billion order for 50 Boeing 737-800s. Deliveries were to begin in May 2009.

July 13: Bombardier Aerospace announced launch of its new C-Series regional airliner, together with signature of a Letter of Interest for 30 of the type, plus 30 options, from Lufthansa. Two 110-seat variants (Series 110 and 110ER) and three 130-passenger versions (130, 130ER and 130XT) were proposed. Lufthansa firmed-up its order on March 11, 2009.

July 14: The first Boeing 777-200LRF freighter made its maiden flight from Paine Field, Everett, Washington. At the time, eleven customers had ordered 78 of this variant.

July 14: BAE Systems unveiled a full-scale mock-up at Farnborough of its Mantis high-altitude, deep and persistent, long-range unmanned autonomous system advanced concept technology demonstrator.

July 14: Etihad Airways announced major orders from Airbus for 20 A320s (plus five options and 15 purchase rights), 25 A350s (plus ten options and 15 purchase rights), ten A380s (plus five options and five purchase rights). Major orders were at the same time placed with Boeing by the airline for 35 787 Dreamliners (plus 25 options and ten purchase rights) and ten 777-300ERs (plus ten options and five purchase rights).

July 15: Dubai-based DAE Capital signed a $12.6 billion contract for 30 Airbus A350-900s and 70 A320s.

July 16: Russian leasing company Ilyushin Finance placed a firm order with United Aircraft Corporation for 31 Tupolev Tu-204SMs, with options on a further 30.

July 17: Asiana Airlines contracted to purchase ten Airbus A350-800s, ten A350-900s and ten A350-1000s with options on a further ten. Deliveries will begin in 2016.

July 17: Air China signed a $6.3 billion firm order with Boeing for 30 737-800s and 15 777-300ERs.

July 24: India re-issued a Request for Proposals for 197 new, off-the-shelf light utility helicopters, 133 of which will join the Indian Army, while the remaining 64 will be for the Indian Air Force.

July 28: Emirates Airline took delivery of its first Airbus A380 in Hamburg, Germany, and at the same time signed a Letter of Intent for 30 Airbus A330-300s and 30 A350-900s.

August 4: The first production Hawk Mk 128 Advanced Jet Trainer for the Royal Air Force made its maiden flight from BAE Systems' factory airfield at Brough, East Yorkshire.

August 6: BAE Systems flew the first production Tranche 2 Eurofighter Typhoon for the Royal Air Force at Warton, Lancashire. The RAF plans to take delivery of 89 Tranche 2 aircraft. The first two were delivered to RAF Coningsby, Lincolnshire, on October 21, 2008.

The first Saab JAS39D Gripen for the Royal Thai Air Force (RTAF) seen during its maiden flight on September 16, 2009, from Linköping, Sweden. The RTAF has four JAS39Cs and two JAS39Ds on order. SAAB

AgustaWestland's first prototype AW159 Lynx Wildcat undertakes its maiden flight at Yeovil, Somerset, on November 12, 2009. Three Wildcats will be used in the development programme and 62 production examples will be delivered to the Army Air Corps (which will take 34) and Fleet Air Arm (28 are on order). AGUSTAWESTLAND

August 8: American Airlines placed a firm order for 26 Boeing 737-800s, which will be used to accelerate retirement of the airline's McDonnell Douglas MD-82/83s.

August 12: Boeing rolled out the first P-8A Poseidon multi-mission maritime aircraft at Renton, Washington. The US Navy will receive 108 of the type to replace the P-3C Orion.

August 19: Eurocopter handed-over the first three EC635P2i helicopters to the Swiss Air Force, which has 20 on order to replace the Alouette III.

August 27: Sikorsky Aircraft flew its X2 technology demonstrator for the first time at its Schweizer Aircraft rapid prototyping facility at Elmira-Corning Airport, Horseheads, New York State.

September 3: Bombardier Aerospace's 100-passenger CRJ1000 NextGen made its maiden flight from Montreal-Mirabel Airport, Quebec, Canada.

September 16: The first of 24 Boeing F-15SG Eagles for the Republic of Singapore Air Force made its maiden flight from St Louis-Lambert International Airport, Missouri.

September 17: The first four South Africa Air Force JAS39D Gripens were officially handed-over at Air Force Base Ysterplaat.

September 22: AgustaWestland flew the first pilot production VH-71 for the US Presidential helicopter replacement programme, which has since been cancelled due to cost overruns.

September 28: Airbus officially opened a Chinese final assembly line for the A319 and A320 at Tianjin.

September 30: Alenia North America was awarded a contract to refurbish 18 retired former Italian Air Force G222 transport aircraft for operation by the Afghan National Army Air Corps.

October 1: Viking Air completed the maiden flight of the first new-production de Havilland Canada DHC-6 Twin Otter Srs 400 at Victoria International Airport, British Columbia, Canada.

October 15: Alenia North America handed-over the first C-27J Joint Cargo Aircraft to the US Army at the L-3 Integrated Systems facility in Waco, Texas.

October 15: American Airlines signed a purchase agreement for 42 Boeing 787-9 Dreamliners, with purchase rights on a further 58.

October 16: The US Army's Bell ARH-70A Armed Reconnaissance Helicopter programme was officially cancelled due to cost overruns. A total of 512 ARH-70As had been due for delivery to the US Army to replace the OH-58D Kiowa Warrior.

October 20: BAE Systems flew the first Eurofighter Typhoon for the Royal Saudi Air Force at Warton, Lancashire. A total of 72 are on order for Saudi Arabia, 24 of which are being built in the UK and the remainder in Saudi Arabia.

October 29: The US Department of Justice granted approval for the merger of Delta Air Lines and Northwest Airlines, which will form the world's largest airline.

November 7: Spanish tourism company Grupo Marsans placed a firm order with Airbus for 12 A319s, 25 A320s, five A321s, five A330-200s, ten A350-900s and four A380s for operation by its subsidiary airlines, including Air Comet.

November 12: The first of four C-130J-30 Super Hercules for the Royal Norwegian Air Force was handed over at the factory in Marietta, Georgia.

November 15: The first Sikorsky CH-148 Cyclone for the Canadian Forces made its maiden flight from the manufacturer's West Palm Beach Development Flight Center in Florida. A total of 28 are on order to replace Canada's CH-124 Sea King fleet.

November 18: The first of 12 EADS CASA C-295M transport aircraft for the Portuguese Air Force was handed over.

November 18: Hawker Beechcraft was awarded a contract by the US Air Force for the production of 23 Beech 350ER King Airs modified into MC-12W Liberty aircraft for the intelligence, surveillance and reconnaissance role in Afghanistan and Iraq.

November 28: The Commercial Aircraft Corporation of China's ARJ21-700 Xiangfeng airliner made its maiden flight from Dachang Airport.

December 5: The first new Lockheed Martin Block 52+ F-16C for the Hellenic Air Force made its maiden flight from Fort Worth, Texas.

December 16: Northrop Grumman unveiled its stealthy, tailless X-47B Unmanned Combat Air system Demonstrator at Palmdale, California. The aircraft will be used to demonstrate launch and recovery from aircraft carriers plus autonomous aerial refuelling.

December 23: France announced an order from the Brazilian Armed Forces for 50 Eurocopter EC725 Cougars, which will be assembled locally in Brazil by a consortium formed by Eurocopter and Helibras.

2009

January 2: India announced selection of the Boeing P-8I Poseidon, eight of which will be purchased to replace the Indian Navy's Tupolev Tu-142MKs.

January 12: FedEx Express exercised options for an additional 15 Boeing 777-200LRF Freighters, adding to 15 already on order.

February 7: Sikorsky flew the first prototype S-76D helicopter at West Palm Beach, Florida.

February 25: The United Arab Emirates announced that it will purchase 12 Lockheed Martin C-130J-30 Super Hercules for its Air Force.

March 17: Boeing unveiled its proposal for the F-15SE Silent Eagle, a stealthier and more survivable variant of the F-15E Strike Eagle with reduced radar cross-section, new digital electronic warfare system

Gulfstream Aerospace's flagship G650 business jet seen during its maiden flight from Savannah, Georgia, on November 25, 2009. GULFSTREAM AEROSPACE

and optional internal weapons carriage.

March 25: Sikorsky delivered the 100th UH-60M Black Hawk to the US Army at its facility in Stratford, Connecticut.

April 4: General Atomics undertook the first flight of its stealthy, turbofan-powered Predator C Avenger unmanned air vehicle from the Gray Butte Flight Operations Facility at Palmdale, California.

April 6: US Defense Secretary Robert Gates announced cancellation of the VH-71 presidential helicopter programme, due to cost and schedule overruns, together with the US Air Force's combat search and rescue helicopter programme to acquire replacements for 146 MH-60G Pave Hawks.

April 14: Embraer announced launch of the KC-390 military transport development programme. The Brazilian Air Force is expected to be the launch customer and service entry is planned for 2015.

April 25: Boeing undertook the maiden flight of the first P-8A Poseidon for the US Navy from Renton, Washington.

April 29: Bell Helicopter Textron announced that it had been awarded a contract to produce 24 Bell 407 helicopters for the Iraqi Air Force. First delivery is due in late-2010.

May 13: AgustaWestland received an order for 16 Boeing ICH-47F Chinook helicopters from the Italian Army. Boeing will supply fuselages for the helicopters, which will then be assembled in Italy by AgustaWestland.

The prototype Airbus Military A400M military airlifter is seen here during its maiden flight on December 11, 2009, from Seville-San Pablo Airport, Spain. AIRBUS MILITARY

May 14: Vietnam announced that it has ordered 12 Sukhoi Su-30MK2 multi-role fighters from Rosoboronexport. Deliveries are due to commence in 2010.

May 18: The first Airbus A320 to be produced from the final assembly line at Tianjin, China, made its maiden flight from there. It was delivered on July 9 to Sichuan Airlines.

ABOVE: *Russia's fifth-generation PAK-FA combat aircraft, also known as the Sukhoi T-50, is seen here during its maiden flight from Komsomolsk-on-Amur, Russia, on January 29, 2010.* SUKHOI

BELOW: *The Boeing 787 Dreamliner takes off for its first flight on December 15, 2009, from Paine Field, Everett, Washington.* BOEING

June 2: The US Air Force Research Laboratory's Lockheed Martin Advanced Composite Cargo Aircraft made its first flight from Palmdale, California. Based on a Fairchild Dornier 328JET, it features a new, wider composite fuselage and new composite tail. On October 19, 2009, Air Force officials announced that it had been given the X-55A designation.

June 4: The first Airbus A330-200 for tanker conversion under the Royal Air Force's Future Strategic Tanker Aircraft programme made its maiden flight at Toulouse, France. It was delivered to Getafe, Spain, on July 10 for conversion to commence.

June 4: The first NH90 for the Royal New Zealand Air Force (RNZAF) flew for the first time at Marignane, France. Eight are on order for the RNZAF.

June 23: The first two Eurofighter Typhoons for the Royal Saudi Air Force departed from Warton, Lancashire, on their delivery flight.

July 1: The first C-17A Globemaster III for the NATO Heavy Airlift Wing made its maiden flight from Long Beach, California.

July 7: The first four Hawker Beechcraft T-6A Texan IIs for the Israeli Air and Space Force were delivered to Hatzerim Air Base, Israel. A total of 20 of the type have been ordered by Israel.

July 8: Boeing unveiled the first F/A-18F Super Hornet for the Royal Australian Air Force at St Louis, Mississippi. It subsequently made its maiden flight on July 20, 2009.

July 27: The Royal Saudi Air Force placed an order with Airbus for three additional A330 Multi-Role Tanker Transports, adding to an order for three placed on January 3, 2008.

July 28: Lockheed Martin formally unveiled the first F-35C Lightning II carrier variant of the Joint Strike Fighter at its facility in Fort Worth, Texas.

July 31: Korea Aerospace Industries rolled out the Surion Korean Utility Helicopter prototype at Sacheon, South Korea. The Surion subsequently made its maiden flight on March 10, 2010. The type has been co-developed with Eurocopter for a Republic of Korea Army requirement.

August 10: Canada's Department of National Defence announced an order for 15 Boeing CH-47F Chinooks for the Canadian Forces. First delivery is due in July 2013.

August 11: Boeing delivered the first of two C-17A Globemaster IIIs to the Qatar Emiri Air Force.

August 18: The Russian Ministry of Defence signed a $2.5 billion contract with Sukhoi for the supply of 64 new fighters to the Russian Air Force, comprising 48 Su-35s, 12 Su-27SM3s and four Su-30M2s. The Su-27SM3s will be remanufacturer from older airframes, while the remainder will all be new production aircraft. All deliveries are to be completed by 2015.

September 10: Hawker Beechcraft's AT-6B armed variant of the T-6A Texan II made its maiden flight in Wichita, Kansas.

September 10: BAE Systems undertook the maiden flight of the first production Nimrod MRA4 for the Royal Air Force at Woodford, Cheshire. It was subsequently handed-over to the Ministry of Defence on March 10, 2010.

September 16: AgustaWestland flew the first Lynx AH9 to be upgraded to AH9A standard at Yeovil, Somerset. New engines give the helicopter more power for hot-and-high operations in Afghanistan. An initial 12 conversions were ordered, but ten more were added on March 29, 2010, meaning all 22 Army Air Corps AH9s will be upgraded to the new standard.

September 16: Boeing's AH-6i light attack/reconnaissance helicopter demonstrator made its first flight in Mesa, Arizona. On May 12, 2010, the Royal Jordanian Air Force signed a Letter of Intent to acquire an unspecified number of AH-6is.

September 16: The first Saab JAS39D Gripen for the Royal Thai Air Force made its maiden flight at Linköping, Sweden. Thailand has four JAS39Cs and two JAS39Ds on order.

September 21: A US Foreign Military Sales contract was awarded to Hawker Beechcraft for the supply of 24 T-6C Texan II training aircraft to the Royal Moroccan Air Force. Deliveries will commence in 2010.

September 23: Embraer undertook the maiden flight of its first Legacy 650 business jet prototype at the company's flight test facility at Gavião Peixoto, Brazil.

September 25: The first refurbished ex-Italian Air Force G.222 transport for the Afghan National Army Air Corps was handed-over at Capodichino, Italy.

September 28: A development prototype for the T129 ATAK light attack helicopter, developed for the Turkish Armed Forces, made its first flight at Vergiate, Italy. An order for 50 of the type, plus 41 options, was placed by Turkey on September 7, 2007.

September 29: Gulfstream Aerospace rolled out its top-of-the-range, flagship G650 business jet at Savannah, Georgia. The aircraft subsequently made its maiden flight on November 26.

Boeing's first 747-8 Freighter is seen with a company T-33 chase aircraft during its maiden flight from Paine Field, Everett, Washington on February 8, 2010. BOEING

October 6: Israel Aerospace Industries rolled out the first Gulfstream G250 business jet at Ben Gurion International Airport, Tel Aviv, Israel. The aircraft subsequently made its maiden flight on December 11.

October 7: Northrop Grumman unveiled the first Euro Hawk unmanned aircraft system at Palmdale, California. Based on the Block 20 RQ-4 Global Hawk, five will be delivered to the German Air Force, beginning in 2011.

October 21: Boeing handed over the 221st and last T-45C Goshawk to the US Navy.

October 21: The BAE Systems' Mantis medium-altitude, long-endurance unmanned air vehicle prototype made its maiden flight over the Woomera Test Range in South Australia.

November 4: South Africa announced cancellation of its order for eight Airbus Military A400M transport aircraft, due to delays and cost escalation.

November 10: Alenia Aermacchi was awarded a contract for the purchase of six M-346 Master advanced jet trainers for the Italian Air Force. Italy eventually plans to acquire 15 of the type, which will be designated the T-346A in Italian service.

November 12: AgustaWestland undertook the maiden flight of the first prototype AW159 Lynx Wildcat at Yeovil, Somerset. Three Wildcats will be used in the development programme and 62 production examples will be delivered to the Army Air Corps (which will take 34) and Fleet Air Arm (28 on order).

November 12: British Airways and Iberia signed a Memorandum of Understanding to merge the two airlines, which will give a combined fleet of over 400 aircraft.

November 13: France approved a programme for the acquisition of a further 60 Dassault Rafales for the French Air Force and Navy, which will bring total orders for the type to 180.

November 13: The first Saab 340 Erieye airborne early warning aircraft for the Royal Thai Air Force made its maiden flight at Linköping, Sweden.

November 16: Cessna rolled out the first production Citation CJ4 business jet in Wichita, Kansas.

November 17: Boeing rolled out the first 747-8 Freighter at Everett, Washington. The aircraft subsequently made its maiden flight on February 8, 2010.

November 17: The United Arab Emirates placed an order for two Saab 340 Erieye airborne early warning aircraft.

November 23: The first of 18 AgustaWestland AW139s for the Qatar Emiri Air Force was handed over in Vergiate, Italy.

November 23: The US Department of Defense gave approval for full-rate production of the Boeing EA-18G Growler electronic attack aircraft. Production of 54 Growlers for the US Navy was then authorized, at a rate of around 20 per year. A total of 88 are ultimately planned to be acquired.

November 24: EADS Deutschland delivered the milestone 200th Eurofighter Typhoon. The aircraft has joined the German Air Force's JG73 at Laage Air Base.

The first Lockheed Martin F-35C Lightning II carrier-capable variant of the Joint Strike Fighter for the US Navy lifts off for its maiden flight from Fort Worth, Texas, on June 6, 2010. LOCKHEED MARTIN

November 25: Australian Government approval was granted for the purchase of an initial batch of 14 F-35A Lightning II Joint Strike Fighters for the Royal Australian Air Force.

November 26: The first two Boeing 737 Wedgetail airborne early warning and control aircraft were delivered to RAAF Base Williamtown, New South Wales. Due to development delays, these are not to the final configuration and will be used mainly for training until the definitive capability is available.

December 4: Eurocopter undertook the maiden flight of its EC175 prototype at Marignane, France. The helicopter has been jointly developed with Chinese manufacturer AVIC, which has designated it the Z-15.

December 8: United Airlines placed orders for 25 Airbus A350-900 XWBs and 25 Boeing 787 Dreamliners, while at the same time taking out purchase rights on a further 50 of each type.

December 11: The prototype Airbus Military A400M military airlifter finally made its maiden flight from Seville-San Pablo Airport, Spain.

December 15: Another long-delayed maiden flight, that of the Boeing 787 Dreamliner, took place at Paine Field, Everett, Washington.

December 29: Embraer delivered the first Phenom 300 light business jet. The aircraft was handed over at São José dos Campos, Brazil, to Executive Flight Services of Kansas City, Missouri.

2010

January 6: The United Arab Emirates announced that it is purchasing six Boeing C-17A Globemaster III transport aircraft.

January 19: Sikorsky was awarded a US Department of Defense contract for 119 H-60 helicopters. This comprised 46 UH-60M Black Hawks and 21 HH-60Ms, plus options on a further ten UH-60Ms for the US Army, together with 18 MH-60Ss and 24 MH-60Rs for the US Navy.

January 24: Embraer delivered the first two EMB-314 Super Tucanos to the Ecuador Air Force at Manta Air Base.

January 26: Delayed maiden flight of the Kawasaki Heavy Industries XC-2 transport aircraft finally took place from Gifu, Japan. The type is being developed as a replacement for the Japanese Air Self-Defence Force's Kawasaki C-1s.

January 29: Russia's fifth-generation PAK-FA combat aircraft, also known as the Sukhoi T-50, made its maiden flight from Komsomolsk-on-Amur, Russia.

February 2: Lockheed Martin undertook the maiden flight of the next F-35 Lightning II prototype, short take-off and vertical landing F-35B BF-03, at Fort Worth, Texas.

February 16: Maiden flight of the first new-build DHC-6 Twin Otter Series 400 in Calgary, Alberta, Canada. The aircraft will be delivered to Zimex Aviation in Switzerland.

February 24: The US Department of Defense launched a new Request for Proposals for the USAF KC-X programme to acquire 179 new aircraft to replace its current KC-135R aerial refuelling tanker fleet.

March 3: Maiden flight of the first CC-130J Super Hercules for the Canadian Forces at Marietta, Georgia.

March 4: The ATR42-600 prototype made its first flight from Toulouse, France.

March 11: AgustaWestland secured a contract from the Government of India for 12 AW101 helicopters that will be operated by the Indian Air Force on VIP transport duties.

March 15: PZL Mielec unveiled the first S-70i Black Hawk to be assembled in Poland, where the type is now being built following take-over of the company by Sikorsky.

March 18: The Chinese-developed Aviocopter AC313 large transport helicopter made its maiden flight at Jingdezhen, China.

March 19: The UK Ministry of Defence confirmed that it has agreed to purchase three Boeing RC-135V/W Rivet Joint aircraft to replace the Royal Air Force's Nimrod R1 fleet. They will be converted from surplus US Air Force KC-135R Stratotankers.

March 26: The first five Royal Australian Air Force F/A-18F Super Hornets arrived at RAAF Base Amberley, Queensland, after a transpacific delivery flight from the USA.

March 29: Maiden flight of the Hindustan Aeronautics Ltd Light Combat Helicopter prototype at HAL Airport, Bangalore.

April 1: Australia's Virgin Blue announced an order for up to 105 Next-Generation Boeing 737s, comprising a firm order for 50 737-800s (with the option to change to 737-700s or -900s), 25 options and 30 purchase rights.

April 22: The Indian Navy issued a request for information seeking 50 utility helicopters to replace its HAL Chetaks.

April 22: US Congress was formally notified of the Indian Air Force's intention to purchase ten Boeing C-17A Globemaster IIIs through a Foreign Military Sa

April 28: The prototype Antonov An-158 99-seat air made its maiden flight from Kiev-Gostomel, Ukraine.

May 3: The Indian Coast Guard issued a Request Information (RFI) for the planned purchase of 16 m shipborne light helicopters for maritime surveillance a SAR. The following day it also issued another RFI for additional, shore-based helicopters for similar roles.

May 3: Continental Airlines and United Air agreed to merge to form the world's largest airline, w more than 700 aircraft and 88,000 staff.

May 4: Viking Air announced an order from Vietnamese Navy for six new DHC-6 Twin Otter Se 400 amphibians, including three in Guardian maritime patrol configuration.

May 10: Boeing unveiled its Phantom Ray unmann air system advanced technology test-bed in St Lo Missouri. First flight is scheduled for December 201

May 13: Korea Aerospace Industries complet production of the 50 T-50 Golden Eagles on order the Republic of Korea Air Force with delivery of the fi aircraft to Gwangju Air Base.

May 14: The US Department of Defense approve new, multi-year US Navy procurement plan for the F 18E/F Super Hornet and EA-18G Growler. This will res in the purchase of 66 Super Hornets and 58 Growl over a four-year period from Fiscal Year 2010.

May 28: The US Air Force announced that it h taken delivery of its 454th and final Hawker Beechcr T-6A Texan II.

June 6: The first Lockheed Martin F-35C Lightn II carrier-capable variant of the Joint Strike Fighter the US Navy made its maiden flight at Fort Worth, Tex

June 8: Dubai, UAE-based Emirates Airline sign an $11.8 billion contract for 32 Airbus A380s, makin the largest ever commercial aircraft order and bring Emirates' total firm orders for the type to 90.

June 16: The first General Electric-powered Boe 787 Dreamliner, the fifth example to fly, made its mai flight from Everett, Washington. On the same day fleet passed the milestone of 1,000 hours of flight test

June 26: The first four F-16 Block 52M fighters the Pakistan Air Force from a batch of 18 (12 F-1 and six F-16Ds) ordered on December 31, 2007, arrived at Shahbaz Air Base, Pakistan.

The first General Electric-powered Boeing 787 Dreamliner, the fifth example to fly, seen during its maiden flight from Everett, Washington on June 16, 2010. On the same day the fleet passed the milestone of 1,000 hours of flight testing. BOEING

the SPIRIT of GREAT BRITAIN

Photo © John Dibbs

A True Story of British Grit and Determination to succeed against all the odds.

Appearing at an Air Show near you this Summer!

Be part of it!

Individuals or Companies can make a difference by showing support.

There are many ways you can be part of it...

- Sign up to our free weekly newsletters
- Join the supporters club TODAY!
- Join our monthly prize draw, with over £1,000 to be won every month!
- Donate a little each month by standing order
- E-donate at anytime online
- Become a Sponsor for an event
- Become a Vulcan Volunteer
- Join our Private Partnership Programme from only £250, or Commercial Partnership Programme from only £500
- Set up a bequest to leave a legacy

visit: **www.vulcantothesky.org**
or call us on **01455 637 864**

Buy XH558 Merchandise at: www.vulcantotheskystore.co.uk

Vulcan To The Sky Trust (Charity No. 1101948)
1 & 2 Venture Court, Dodwells Road, Hinckley, Leicestershire LE10 3BT

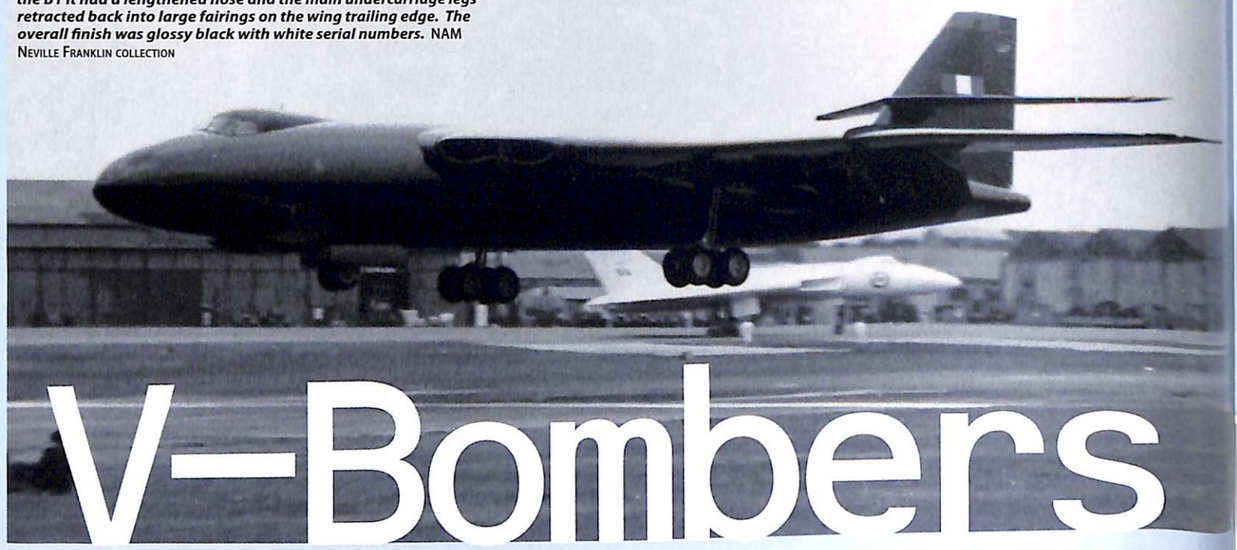
HONOURING THE PAST

XH558 FIFTIETH ANNIVERSARY
1960 - 2010

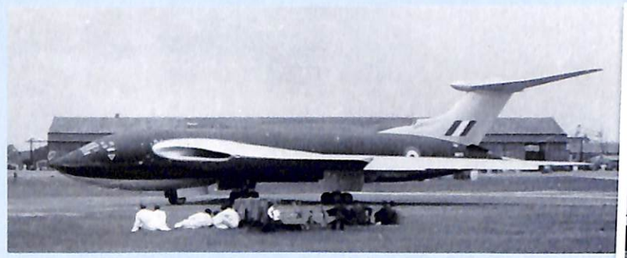
INSPIRING THE FUTURE

UNIQUE CORPORATE SPONSORSHIP OPPORTUNITIES - Call: MICHAEL TROTTER on 07803 141483

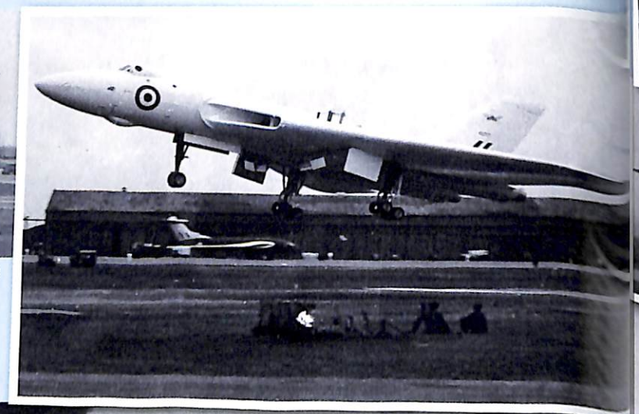
BELOW: *Sole example of the Valiant B2 was WJ954. Compared to the B1 it had a lengthened nose and the main undercarriage legs retracted back into large fairings on the wing trailing edge. The overall finish was glossy black with white serial numbers.* NAM NEVILLE FRANKLIN COLLECTION



V-Bombers AT FARNBOROUGH



ABOVE: *Victor WB771 was one of two prototypes built. A futuristic-looking machine, it was lost in a crash at RAF Cranfield in July 1954.* NAM NEVILLE FRANKLIN COLLECTION
RIGHT: *Vulcan B1 VX777 was the second prototype, seen here landing at the 1953 air show. Note the Victor prototype waiting in the background.* NAM NEVILLE FRANKLIN COLLECTION
BELOW: *Valiant B1 XD875 at the 1957 Farnborough Air Show. XD875 was the last Valiant ever built and was first flown on August 27, 1957. The nose is preserved near Inverness in Scotland.* NAM NEVILLE FRANKLIN COLLECTION



ABOVE: *Vulcan B1 XA903 at Farnborough on March 1, 1979. XA903 was the last B1 airworthy at the time and had been used by Bristol and Rolls-Royce for engine test-bed work, as can be seen by the 'pod' underneath the fuselage. It eventually ended its days at Farnborough, being scrapped in the early 1980s.* GLENN SANDS COLLECTION BELOW: *Vulcan B2 XH534 seen at the 1960 air show. One of the first B2s, XH534 was eventually scrapped in 1982.* KEY COLLECTION

ABOVE: *Typically spirited Vulcan display in the mid-1950s in equally typical Farnborough weather.* NAM NEVILLE FRANKLIN COLLECTION
RIGHT: *Vulcan prototype VX770 overflys an early Valiant at an air show in the mid-1950s. VX770 first flew on August 30, 1952 piloted by Wg Cdr R J 'Roly' Falk, Avro's Chief Test Pilot. Several spectacular Farnborough appearances followed, including a full roll at the 1955 air show.* GLENN SANDS COLLECTION

ACKNOWLEDGEMENT

Many of the images were kindly supplied by the Newark Air Museum (NAM), for which more details can be found at www.newarkairmuseum.org

ABOVE: *Formation of two Valiant B1s and two Vulcan B1s at the 1957 event. The Vulcan had been in service for just a year with 32 Squadron, while the Valiant had been in service for three years.* GLENN SANDS COLLECTION

VULCAN XH558'S APPEARANCE AT THE 2008 AIR SHOW WAS THE FIRST FOR A V-BOMBER SINCE THE 1980S. ENJOY A PICTORIAL GLANCE BACK AT THE HEYDAY OF THE VALIANT, VICTOR AND VULCAN OVER HAMPSHIRE AT A TIME WHEN BRITISH AEROSPACE INDUSTRY LED THE WORLD.

JF-17 Thunder

From Dreams to Reality

AFM's Alan Warnes, who has been fortunate enough to visit the JF-17 unit three times and to fly with the jet, tells the story of the fighter set to be the main attraction at this year's FIAS.

WHERE THERE was doubt there is now hope. Ten years ago the future of the Sino-Pak JF-17 Thunder lightweight fighter, or Super-7 as the project was known then, looked pretty bleak. It was not because of a lack of funding, or anything as straightforward as that. No, the problems stemmed from the strong beliefs held by the Pakistan Air Force (PAF) in western avionics, ejector seats and missiles – the very things the PAF could not acquire because of international sanctions that arose after the Pakistan Government's reluctance to sign the 1989 Nuclear Non Proliferation Act.

As a result, the fighter's future was in jeopardy. The PAF's only real option was their long time ally, China, but although they offered what they could it just wasn't what the PAF wanted. The PAF was effectively developing this jet with a view to manufacturing it – the first air force ever to try anything so ambitious.

Then in November 2000, Air Chief Marshal Mushaf Ali Mir took over as Pakistan Air Force Chief of Air Staff (CAS). That was when the breakthrough came. He had been the Chairman of Pakistan Aeronautical Complex Kamra for 20 months and the problems of this fighter had taken up much of his time.

Immediately upon being promoted to CAS, he ordered the 'decoupling' of the avionics system, which was at the heart of the delays, from the fighter's design. He gambled that by the time the Chinese and engineers had developed the airframe, an avionics package would be available. It was a strategy that the PAF had stumbled upon, but it meant the aircraft would have a modern avionics system and not an old one from the era it was designed in the late-1990s.

Painted in the colours of Pakistan and China, aircraft 07-102 (Serial Batch Production -1), taxies out at Kamra-Minhas in March 2007, to make its public debut at the Pakistan National Armed Forces Day Parade.

FIRST FLIGHT

After two years of design, the Super-7 flew from the Chengdu Aircraft Corporation factory on August 25, 2003, with Chinese pilot Wang Wenjian at the control. The same day it was re-designated the JF-17 and named Thunder. While it was a momentous occasion, it was tinged with sadness as ACM Mushaf was not fortunate enough to see his dream turn into reality.

Four heavily laden JF-17 Thunders head towards Thal Bombing Range on April 4, 2010. The nearest two aircraft are carrying a single 2,000 lb (908 kg) bomb each, while the furthest pair are each carrying two 500 lb (227 kg) Mk 84 bombs. Flying the nearest aircraft is the 26 Sqn CO, Wg Cdr Khalid Mehmood.

ALL PHOTOS, AUTHOR UNLESS STATED OTHERWISE

Sadly, he had been killed with his wife and 15 other PAF personnel just six months earlier, when a Fokker F-27 Friendship they were travelling in crashed.

After the initial JF-17 aircraft 'PT-1' made its first flight, five more prototypes followed as the Pak-Sino collaboration picked up pace.

The four flying prototypes were being used in the test programme by the end of 2006. Two of them, PT-1 and PT-3, were tasked for flight envelope and design testing while the other flyable pair, PT-4 and PT-5, participated in the programme to expand the jet's flight envelope and avionics tests. Two jets, PT-2 and PT-5, were used as static test rigs.

Flight testing was carried out at Chengdu, by an embedded PAF unit and its four test pilots. Meanwhile the Pakistan Aeronautical Complex Kamra set about building its own JF-17 production facilities – quite an ambitious feat for a company that had no experience of building a fighter, having cut its teeth on assembling MFI-17 Mushshak propeller trainers and parts for the K-8 Karakoram jet trainers.

Where it does have plenty of experience however, is working on Chinese fighters, because since 1980, PAC Kamra has been carrying out the overhaul and maintenance of the PAF's fleet of Shenyang F-6s, Shenyang FT-5s, Chengdu F-7P/PGs, Nanchang A-5IIIs and more recently the K-8 Korakoram. With the PAF having a requirement for up to 250 JF-17s to replace A-5IIIs, Mirages and F-7P/PGs, PAC Kamra is going to be busy over the next ten years.

ABOVE: ***All the squadron pilots and senior engineering personnel stand with the specially marked JF-17, 09-111 which was the first aircraft to be built at PAC Kamra.***

BELOW: ***A JF-17 lifts off Kamra-Minhas runway bound for Rafiqui on April 13, 2010, as part of its operational evaluation.***

TO PAKISTAN

The first two JF-17s were air-freighted to Pakistan in February 2007, ensuring they would be airworthy for their public debut on Pakistan's Armed Forces Day on March 23. That was the day the general public saw their new fighter in action.

Wg Cdr Ahsan Rafiq, the JF-17 Tactics and Evaluation OC, flew a faultless display over the Islamabad grandstand where all the VIPs, including President Pervez Musharraf, looked on. The many TV cameras ensured that everyone in Pakistan and the rest of the world would get the opportunity to see this memorable moment unfold. I was fortunate enough to be invited to Kamra-Minhas to see the two aircraft depart the base on this historic day. I watched as both pilots – the other one was Sqn Ldr (now Wg Cdr) Hakim Raza, who flew in the spare aircraft – stepped in to the fighters.

The pair taxied out with little fuss and with their RD-93 engines switched to afterburner, they roared down the runway and lifted up into the air. The display over Islamabad and the specially marked aircraft, with the Pakistan flag painted underneath its fuselage and wings, wooed the crowd with its display. Both jets returned and the tension that was evident before they departed had been replaced with a sense of jubilation – although as is always the case in Pakistan, it was done with great dignity.

For a year, the JF-17 Tactical and Evaluation Unit which had stood up on February 20, 2007 continued with its work, using just the two aircraft while just a stone's throw away, PAC Kamra started to ramp up its sub-assembly production.

On January 22, 2008 the JF-17 production line at PAC Kamra, which falls under the responsibility of the Aircraft Manufacturing Factory, was officially opened. The programme received a huge boost in February 2008, when JF-17 T&E took on three more Serial Batch Production (SBP) delivered from China, followed by another three in March 2008. Four of them performed in Pakistan's Armed Forces Day that month too and with a huge increase in available aircraft, the JF-17 trials work was significantly boosted.

By late-2008 the emphasis was being placed on the operational evaluation of the PAF's air to ground weapons, as plans to stand up an operational squadron were stepped up. Unfortunately unforeseen delays outside of the PAF's control meant that these plans were postponed for the time being. However, in March 2009 the PAF signed a contract with CATIC for 42 aircraft, with 40 being built in Pakistan.

On November 23, 2009, another major breakthrough came when the first locally assembled JF-17 was rolled out at PAC Kamra in a big ceremony with the Pakistan Prime Minister, Syed Yusf Raza Gillani, present.

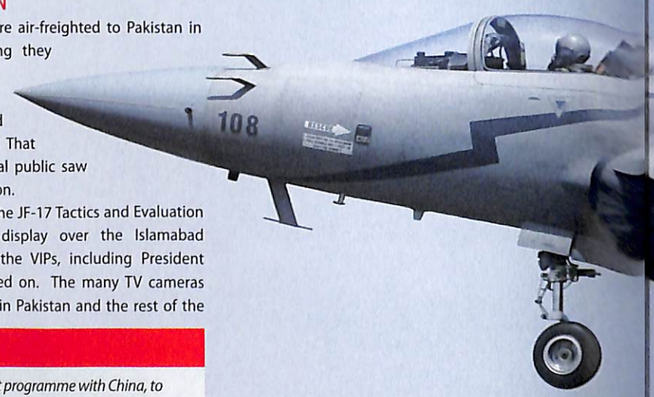
Initially the JF-17s are being made from just 20% of local material but by the time the 40th aircraft rolls off the line in 2012 this should have increased to 58%. As technology transfer increases, the manufacturing process will be stepped up to two a month and by 2015 around ten squadrons will have re-equipped. Even more exciting is that Pakistan will have nurtured an aerospace industry. Its one thing building an aircraft, it's a completely different story when there is no such existing industry, without any suppliers or specialists. Pakistan is building all this up from scratch.

On February 18, 2010, the first JF-17 unit, 26 Squadron traded in its old A-5IIIs for the new fighter, with Wg Cdr Khalid Mahmood taking over as CO. He has the mammoth task of ensuring that all the test and evaluation is carried out, as is operational flying and that all new pilots undergo the appropriate training, with two other Instructor Pilots. When I met him in April, he was also preparing the unit for another 'out of area' deployment to Rafiqui as part of the JF-17's operational evaluation.

April 2010 also saw a staggering eight aircraft delivered to 26 Sqn, as deliveries of the first Block 1 aircraft with Chinese avionics including the KLJ-7 radar, continued. Meanwhile the Chinese TY-6 ejector seats fitted into the first aircraft are now being swapped for Martin Baker MK 16 PK16LE ejector seats. Yes, the JF-17 dream is turning into reality!

The PAF Chief of Air Staff, Air Chief Marshal Rao Qamar Suleman, has ultimate responsibility of the JF-17 Thunder programme. PAF

Wg Cdr Khalid Mahmood, Commanding Officer of 26 Squadron, the first JF-17 unit of the Pakistan Air Force.



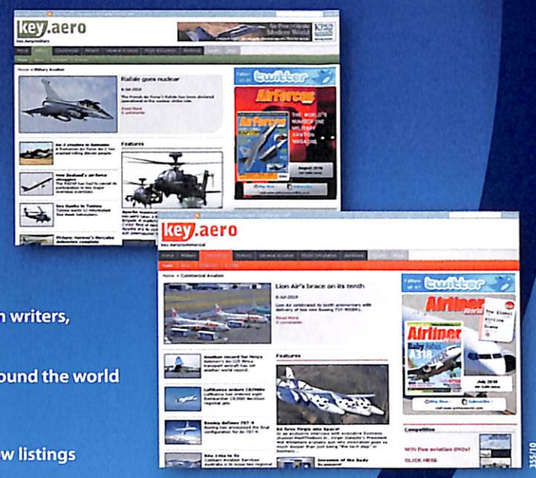
JF-17 – ITS ROOTS

Back in the early 90s the Pakistan Air Force (PAF) had dreams of embarking upon a joint programme with China, to design a fighter that could fulfil both of their future needs. In addition to replacing its ageing fleet of F-6 fighters, Pakistan hoped it could sell the aircraft to other countries as well as provide a basis for Pakistan to develop its own indigenous aviation industry. While there had been initial tripartite discussions between China, Pakistan and the US to develop a fighter known as Sabre II in 1989, escalating costs killed off the project, which would have ended up being more expensive than a basic F-16. Nevertheless, three years later in 1992, China, keen to assist their Pakistani friends and at the same time gain some of their operational and technical know-how, proposed the development of a lightweight fighter. It would meet the PAF's requirement on the principles of equal funding, along with joint risk and benefit sharing. In 1996 the PAF ratified its Super 7 Air Staff Requirement and two years on, in 1998, both governments entered into an agreement on equal partnership and equal funding which would be known in China as the Chengdu FC-1.

key.aero

The Homepage of Aviation

Brought to you by Key Publishing, Europe's Leading aviation publisher, Key.aero is a new website designed to be your complete information source for Military, Civil, Historic and General Aviation as well as Flight Simulation.



Constantly updated by our team of top aviation writers, Key.aero features:

- All the latest aviation news from around the world
- In-depth features and articles
- Comprehensive event and airshow listings
- Discussion forum with over 15,000 members
- Exclusive online competitions and polls
- RSS Feed – receive the aviation news you want direct to your desktop

AND MUCH MORE! Visit your new one-stop aviation website today:

Log on at www.key.aero

335/10

70 YEARS ON

RAYMOND GUBBAY presents

BATTLE of BRITAIN

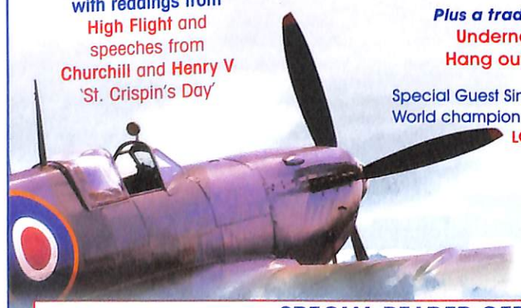
REMEMBERED IN MUSIC

Take a trip down memory lane and remember our heroes with a programme of wartime hits to commemorate this defining moment of British history.

Wartime favourites A NIGHTINGALE SANG IN BERKELEY SQUARE THE WHITE CLIFFS OF DOVER CALLING ALL WORKERS GOODNIGHT SWEETHEART MOONLIGHT SERENADE DAM BUSTERS MARCH WE'LL MEET AGAIN NIMROD FROM ENIGMA VARIATIONS IN THE MOOD LILLI MARLENE THERE'LL ALWAYS BE AN ENGLAND RULE, BRITANNIA! LAND OF HOPE AND GLORY

Plus a traditional Singalong to forties favourites
Underneath the Arches Run Rabbit Run
Hang out the washing on the Siegfried line

with readings from High Flight and speeches from Churchill and Henry V 'St. Crispin's Day'



Special Guest Singer JESSIE BUCKLEY RAF Bugler PAUL SUTTON
World champion dancers CHRIS MARQUES & JACLYN SPENCER
LONDON CONCERT ORCHESTRA
Conductor JAE ALEXANDER

Presented by LESLIE PHILIPS

Saturday 11 September at 7.30pm
ROYAL FESTIVAL HALL
TICKET OFFICE 0844 847 9910

SPECIAL READER OFFER – SAVE £5.00 ON TICKETS
As a special offer for readers, we are happy to offer you a £5.00 discount on ticket prices.
Simply call the Ticket Office before 30 August on 0844 847 9910 and quote 'Farnborough Offer' at the time of purchasing your seats.
Conditions: offer is subject to availability and does not apply to tickets already purchased. Offer closes on 30 August and tickets are non-refundable and non-exchangeable. Offer not available online and excludes the lowest ticket price.

BRISTOL FASHION

CELEBRATING A CENTENARY OF AVIATION AT FILTON

Mick Britton reviews British aerospace manufacturing in the Bristol area, past and present.

ABOVE: *Classic image of Bristol's mighty Brabazon coming in to land at Farnborough over the memorial to Samual Cody, the first man to fly from British soil.* IMAGE VIA BILL NAPIER
BELOW: *The Bristol Boxkite was the first truly successful mass-produced aeroplane to come from the Filton factories.* KEY COLLECTION

The year 1910 was a highly significant one in British aviation history, recognised by its principal chronicler R Dallas-Brett in his magnum opus *The History of British Aviation 1908 - 1914* as witnessing its 'blossoming forth'. Up and down the country various pioneers were experimenting with flying machines of their own design with varying degrees of success. In the Essex marshes A V Roe had already made the first successful flight of an entirely British-built machine, whereas in the north of England Robert Blackburn, founder of Blackburn Aircraft, was trying to emulate that achievement on Redcar beach. Down Bristol way in the West Country however, Sir George White, not a pilot but a business man and pioneer of Electric Tramways established the British

Bristol's F2b Fighter was the zenith of technology during the First World War. KEY COLLECTION

and Colonial Aeroplane Company. This, the country's first aircraft factory, was set up in some disused tram sheds at Filton on the northern edge of the city with the purpose of manufacturing the more advanced machines of French design under licence. This was at a time when the other pioneer aeroplane makers were constrained by small workshops, such as AV Roe's railway arch, Blackburn's railway stables and de Havilland's carpenters' workshop.

FIRST AIRCRAFT

Although White's first product, the Zodiac biplane, was a failure, the second – a Farman design known as the Boxkite – was more successful, quickly establishing a reputation as the best training aircraft used in the Army's Autumn manoeuvres (where in the hands of Robert Loraine it made the first air-ground wireless transmission in the UK). It won the first of several export orders that year, which would be followed by others to Bulgaria, Romania and Russia, causing Dallas-Brett to comment on the irony of a situation in which the British Government found it necessary to place its aeroplane orders in France whilst others were buying the very machines on which its own pilots were being trained. Confident of its product the British and Colonial Aeroplane Company dispatched display teams to India and Australia on sales tours and were rewarded the following year with a government order. In 1912 the company employed the Romanian designer Henri Coanda, which enabled it to start producing aircraft to its own specifications, the first being the Coanda monoplane. Whilst this was shunned by the War Office following the crash of another monoplane, which was blamed on its design, it was built under licence in Italy. Coanda was succeeded at the company by Frank Barnwell, whose promising first design, the Scout, made its maiden flight in 1914. At the outbreak of World War One, during which the aeroplane would come of age, 'British and Colonial' had become the most respected British aircraft manufacturer. According to Dallas Brett, this alone had upheld British prestige abroad: "Their reliable old Boxkites and sprightly monoplanes were flown all over Europe, and in India, the Far East and the Antipodes, and gained a reputation for sound workmanship which did much to undermine the overpowering influence of the French."

The company's greatest contribution to the Allied victory was undoubtedly the highly successful F.2A Fighter, which subsequently became known as the Bristol Fighter, the first genuine multi-role type produced by the British aircraft industry. It was equally at home as a fighter or bomber and served on in an Empire policing role into the 1930s. In common with other aircraft manufacturers the company struggled when orders for its products dried up after the Armistice and so it was forced to undergo a transformation into the Bristol Aeroplane Company (another one of the four company names initially registered by White) in an effort to avoid bankruptcy. In order to survive it took the opportunity to diversify into aero-engine production following the arrival of a talented engine designer, Roy Fedden, whose

ABOVE: ***Bristol's Type 142, the first stressed metal-skin British monoplane, made its maiden flight as 'Britain First' at Filton on April 12, 1935.*** IMAGE VIA BILL NAPIER

BELOW: ***The Type 142 became the Blenheim, of which 4,422 were built in various marks.*** KEY COLLECTION

Bristol's wartime advertisement for its three main bomber types.

Jupiter radial engine did much to keep it in business. Entering production in 1921, it was to prove a successful product and the start of a line of engines all named after mythological figures that would span the next 40 years until the engine division (based at Patchway) was acquired by Rolls-Royce in the 1960s.

During this time the company built upon its success with the Bristol Fighter gaining a reputation as a producer of fighter aircraft for the RAF, commencing with the Bulldog, the maiden flight of which took place in 1927. However, it was the sales of its engines that further enhanced the company's worldwide reputation by establishing a formidable record of achievement. For instance in 1933 Westland Wapitis (powered by Bristol Pegasus engines) made the first flight over Mount Everest, whilst the following year a Caproni aircraft with the same engine set a world altitude record.

WAR CLOUDS GATHER

By 1933 work had almost dried up on the aircraft manufacturing side and the company must have been relieved to receive an order from the newspaper magnate Lord Rothermere for the design of a fast executive aircraft capable of carrying six passengers at a speed of 240mph (faster than any contemporary fighter). The result was the Type 142, the first modern stressed-metal skinned British monoplane with retractable undercarriage, flaps and variable speed propellers driven by a pair of Bristol Mercury engines. The performance of the new aircraft staggered even its designer, Barnwell, when it registered over 300mph on an Air Ministry test flight. Considered ideal as the basis of one of the bomber types with which to re-arm the neglected RAF in the shadow of gathering war clouds following Hitler's rise to power in Germany, the type was ordered in great quantities as the Blenheim. In all 4,422 were built and there were export sales to several countries, including Finland, Greece, Lithuania, Rumania, Turkey and Yugoslavia. Forming the backbone of the RAF's light bomber force at the outbreak of war, the type took part in the early raids on Germany where it suffered heavy losses to the more modern Messerschmitt Bf 109 fighters that were much faster than the biplanes the Blenheim had easily outpaced in its design years. Developed through five marks (including the earliest radar-equipped night-fighter) the type saw service in every theatre of war.

From the Blenheim a succession of twin-engined types (equipped with progressively more powerful engines) was derived that carried the firm through the Second World War, commencing with the heavier Beaufort torpedo bomber, production of which was already underway at the outset of the conflict. Powered by Taurus engines, 2,080 were produced, of which 700 were built in Australia (mostly with American Wasp engines) for service in the Pacific. Its successor, the Beaufighter, marked a return to the company's best fighter tradition being developed to meet an RAF requirement for a long-range fighter. Sharing a common wing, tail and landing gear with the Beaufort, it was extremely heavily armed with a battery of four cannon in the nose, and was powered by two Hercules engines. Developed in a remarkably short timeframe of just six months, it was to become the RAF's first successful night fighter when equipped with the AI Mk 1V radar, particularly in the hands of men like John 'Cat's Eyes' Cunningham, Bob Braham and even master bomber Guy Gibson (whilst on a sabbatical from bombing operations). Like the Blenheim it was to prove very adaptable, leading to the development of several marks culminating in the Torpedo-carrying TF X (known as the Torbeau) for the RAF's Coastal Command and also serving in every theatre of the war. Production ran to almost 6,000 including 346 produced in Australia and it remained in service with some air forces until 1960.

Bristol did not escape the war unscathed – the Filton works was bombed by the Luftwaffe in a daylight raid early on in September 1940 and this gave added impetus to the dispersal of production capacity. By 1944 the company was already looking to the future and planning for the return to peace, seeking to diversify in order to avoid the type of slump it suffered after the end of the First World War. Raoul Hafner joined the company in 1944 to lead the development into helicopters, a new form of air transport pioneered by Igor Sikorsky in the USA, which would ultimately lead to the formation of a new division at Weston-super-Mare.

Work started on the design of a rugged twin-engined transport aircraft for the post-war world with clam-shell front loading doors. Known as the Freighter, it made its maiden flight in December 1945 and went on to play a significant role in shifting awkward cargoes during the Berlin Airlift. This aircraft was developed on the company's own initiative as a private venture, utilising the twin-engined expertise acquired during the war and did not form part of the government's post-war civil aviation programme proposed by the Brabazon Committee. That recommended the development of nine airliner projects, the flagship of which was to be a long-range piston-engined transatlantic airliner named after the Committee Chairman, the manufacture of which was entrusted to the Bristol Aeroplane Company. Other company diversification projects included the production of pre-fab houses to assist the government's urgent housing programme and the production of cars using BMW technology imported as part of German war reparations.

In 1947 Hafner's design efforts came to fruition with the maiden flight of the Sycamore helicopter, which was ultimately ordered in significant numbers by the RAF and other air arms. This was to be followed by the Belvedere, the first successful twin–rotor, twin–engined helicopter (which also served with the RAF) before the Helicopter Division was sold to Westland. The Freighter was also selling steadily around the world and helping open up new markets for isolated areas such as the Australian interior, where it was used to airfreight beef, and a passenger version was developed, known as the Wayfarer. However, Bristol's prestige transatlantic airliner project was a different story.

THE BRABAZON SAGA

The Brabazon was based on one of Bristol's shelved pre-war designs for a 100-ton bomber, resurrected in response to an Air Ministry requirement for a super heavy bomber in the dark days of 1942, utilising eight of the company's latest Centaurus engines. Although this role was ultimately fulfilled by the Avro Lincoln,

Bristol Beaufighter TFX 'Torbeau', a late development of the type. IMAGE VIA BILL NAPIER

Subscribe and Save

Subscribe to your favourite aviation magazine and make great savings on the cover price PLUS claim your **Free Subscription Gift!***

AIRFORCES MONTHLY

AirForces Monthly magazine is devoted to modern military aircraft and their air arms, it provides the best military aviation news coverage from its global network of correspondents and is essential reading for anyone seeking a well-informed view.

AirForces Monthly has built up a formidable reputation worldwide by reporting from places not generally covered by other military magazines.

FLYPAST

FlyPast is internationally regarded as the magazine for aviation history and heritage. *FlyPast* pioneered the reporting of 'living aviation history' and still leads the field today.

Each issue is packed with news and features on warbird preservation and restoration, museums, and the airshow scene. Subjects regularly profiled include British and American aircraft type histories, as well as those of squadrons and units from World War One to the Cold War.

KEY PUBLISHING

AIR INTERNATIONAL

Over the years *AIR International* magazine has established an unrivalled reputation for authoritative reporting and coverage of the full spectrum of aviation subjects. It has correspondents and industry renowned aviation writers from around the world, offering exclusive interviews, profiles and stunning photography. *AIR International* has recently been re-launched to introduce a contemporary and colourful design; there are dedicated news reports, in-depth features and factual insider information.

COMMERCIAL • MILITARY • HISTORIC • AIRLINES • NEWS ANALYSIS
AVIATION NEWS
& Global Aerospace
A380 set for new heights
Mach 5 Record!
Fairey Gannet – Cold War icon or Naval oddity?
ILA – a very German show
Air Time – pilot watches reviewed

AVIATION NEWS

As Britain's longest established monthly aviation journal, *Aviation News* provides up-to-date, accurate and succinct information on every branch of aviation. Whilst the primary focus is on commercial and modern military aircraft, *Aviation News* also features airshows, historic warbirds and general aviation.

The magazine prides itself on providing high-quality information to enthusiasts, detailing airport movements, orders and leases, and registrations.

AIRLINER WORLD

Airliner World magazine is the world's largest selling commercial aviation magazine with subscribers who comprise both industry readers and commercial aviation enthusiasts. Comprehensive news and reporting covers all aspects of airlines, their aircraft, and airports around the globe.

Illustrated throughout with superb colour photography, *Airliner World* also provides the latest on aircraft deliveries, colour schemes and preservation news as well as reviews of books, prints, models and DVDs.

WIN!
Aviation prizes in our free prize draw!
VISIT OUR STAND FOR DETAILS

AIRPORTS OF THE WORLD

Airports of the World magazine is a bi-monthly publication that provides the enthusiast with news and features on the global airport scene. Reporting on airports large and small around the world, it includes articles on both major city hubs and smaller regional airports to leisure and low cost airports. Topics covered include current operations, airline operators, and future plans.

TODAY'S PILOT

Today's Pilot magazine has established itself as one of Europe's leading General Aviation magazines. Aimed at the active flying GA community, the magazine has an industry respected editorial team, covering all aspects of flying from gliding to ultra-lights, kit-planes to twin-engined production aircraft and helicopters to light jets. Each issue contains at least one full flight test report and offers the reader free landing vouchers.

PC PILOT

PC Pilot magazine is Europe's only English-language magazine dedicated solely to computer flight simulation.

Each bi-monthly issue includes reviews of the latest simulation software, whether new stand-alone programmes, add-on aircraft or scenery or utility software for Microsoft's Flight Simulator series. It has assessments of flight control hardware and articles dealing with technical PC issues aimed at both beginners and the more experienced simulation user.

Free CD-ROM with every issue!

Visit us at Stand C1, Hall 1 for more details

Alternatively subscribe at:
www.keypublishing.com/shop

OR

Call UK: **01780 480404**
Overseas: **+44 1780 480404**

* Available at Farnborough International Airshow 2010 only

developed from the iconic Lancaster, the specification in terms of range and performance met the Brabazon Committee's requirements for a transatlantic airliner. Consequently, the company received a contract for two prototypes of its Type 167, a gigantic aircraft with a wider fuselage than today's Boeing 747 Jumbo Jet capable of accommodating 150 seated passengers (or 80 in greater luxury) with such facilities as sleeping berths, a dining room and cinema. In essence, the Brabazon was the first modern airliner produced in Britain and an undeniable engineering achievement incorporating a large number of technological innovations such as powered engine controls, electric flying controls and high-pressure hydraulics.

Unfortunately the project was based on the British pre-war concept of luxury travel for the wealthy few at a time when America was designing airliners for the new mass travel market, soon proven to be the correct market model for the post-war world.

The Brabazon flew successfully, performing its maiden flight at Filton in September 1947 and whilst technologically successful, commercially it was an anachronism and thus regarded as immediately obsolete by the airlines which purchased American aircraft like the DC-6 and Boeing Stratocruiser instead (and generally continued buying American thereafter). The project was finally cancelled by the government in 1953 and the prototypes broken up.

Its legacy was a lengthened runway and huge new assembly hangar at Filton as well as new skills and the know-how to construct large modern airliners, which left Bristol well equipped for future projects beginning with the Britannia. This beautiful aircraft served with both BOAC and the RAF, arriving on the market at a time when the first generation of American jet airliners, like the Boeing 707 and DC-8, were just appearing.

Above: ***The Bristol Wayfarer was a version of its Type 170 Freighter – intended for service during the Second World War, it was not constructed until 1946.*** Image via Bill Napier

Below: ***1948 advertisement celebrating 30 years of Bristol engines.***

Below: ***Concorde will forever be associated with Filton. Here G-BOAF lands at Filton on November 23, 2003, to become a museum piece following the controversial retirement of the type from commercial service.*** Key collection

Although it may have lagged behind American airliners, in other fields the company was at the cutting edge of technology, having formed a Guided Weapons Department as early as 1949. It would develop the Bloodhound missile in conjunction with Ferranti, which would not only serve with the RAF but attract a major export sale to Sweden, probably saving the company thanks to the substantial down payment that was negotiated at a time when it was in danger of being taken over by competitors and broken up.

By the late 1950s the government had recognised that in the modern world an aircraft industry made up of many small firms was no longer capable of competing in world markets. It therefore fostered a programme of amalgamation that saw Bristol merge with Vickers-Armstrong and English Electric to form the British Aircraft Corporation (BAC) in 1959, whilst the remainder merged into Hawker-Siddeley. In the aero engine field a similar process had already started of its own volition when the company's engine division amalgamated with Armstrong Siddeley Engines to form Bristol Siddeley Engines the previous year. The genius of engine designer Stanley Hooker had already won the race with Rolls-Royce to produce the first successful Vertical Take-Off and Landing (VTOL) engine (the Pegasus) which equipped the revolutionary Harrier, although in 1966 Rolls-Royce absorbed its erstwhile competitor and came to dominate the British aero engine industry.

CONCORDE

The 1960s was an era of unbridled optimism when no achievement seemed beyond the capacities of modern technology. The holy grail of the world's aircraft designers (and politicians) was supersonic passenger transport. BAC was central to the British effort in this direction and developed the futuristic Type 188 research aircraft in order to explore the characteristics of supersonic flight. This was too big a project for a cash-strapped British Government to undertake alone, so agreement was reached with the French for BAC to join with Sud Aviation to work on the project to be known as Concorde.

The British prototype Concorde 002 made its maiden flight from Filton in April 1969 and its future looked

Bristol Sycamore, the company's first significant helicopter design. Mick Britton

rosy with many large airlines queuing up with orders. Having had its own supersonic aircraft project cancelled, America suddenly became anti-supersonic flight, denying the aircraft access to its main eastern airports. An abrupt flurry of cancelled deals left the order books empty, save for those of the national airlines of the two partner nations. Thus, although Concorde entered service in 1976, it was in much smaller numbers than originally anticipated, and production only lasted until 1979, by which time BAC had become British Aerospace with the merger of the two large groups formed in 1959. It was not to be a nationalised industry for long, being privatised by Prime Minister Margaret Thatcher's incoming Conservative Government in 1981.

AIRBUS

With no more in-house work following the end of Concorde production, Filton's future could have been in jeopardy, but fortunately British Aerospace had become involved in the production of an exciting and ultimately highly successful European civil airliner – the Airbus A300. The multi-national Airbus project was conceived by Europe's leading aerospace nations of France, Germany and the UK in the 1960s to compete against the giant American firms of Boeing and McDonnell-Douglas.

Building on the success of multi-national aircraft programmes within Europe such as Concorde, Jaguar and Tornado, Airbus is based on sharing the manufacture of components and the profits among the members of the consortium. British Aerospace was responsible for the construction of the wings and fuel systems across the whole range of airliners.

Today there are around 400 firms in the UK supplying Airbus with parts as diverse as cabin seats and electronic sensors. Indeed, now that the UK no longer produces a single model of airliner larger than the Britten-Norman Islander there is no doubt that Airbus has proved to be the saviour of the British civil aerospace industry.

Commencing with the development of the A300, a short-haul jet carrying around 250 passengers that entered service in 1974, the Airbus family has grown to more than a dozen different aircraft culminating with the huge A380, currently the world's largest passenger aircraft and a proven success with sales to many of the world's leading airlines. Wings for this mighty beast are produced at Filton's sister factory at Broughton in North Wales (with a 6,000 strong workforce) and then transported by road and river to Mostyn Harbour where they are loaded onto a roll-on roll-off ferry for the journey to France.

Employing 4,500 people, Filton is involved in the development and manufacture of wings for the latest Airbus product, the A400M, which is a four-engine turboprop multi-role military transport designed with a view to replacing the ageing fleets of C-130 Hercules and C-160 Transall aircraft operated by many of the world's air forces.

Filton is the UK headquarters of Airbus and the design centre for every Airbus wing. It is also the focus of a cluster of Research and Development (R&D) entities in the aerospace industry, including the Composite Structures Development Centre. Working in conjunction with the University of Bristol this is addressing the challenge of manufacturing wings in composite material rather than metal. The engineering activities in which R&D is engaged include Flight Physics, which delivers the data used in the design of aircraft and their components; Structures (the largest part of the Airbus Engineering Organisation in the UK that supports the development of the wings for all its aircraft types); Product Integrity (responsible for the airworthiness of the design of aircraft and related products) and Systems and Integration Engineering (responsible for the design, aircraft integration, certification and in-service support of all aspects of landing gear and landing gear systems). Linking the design and production processes, Manufacturing Engineering plays a vital role in the production of wings for the A400M, translating design into reality by directing the complete wing manufacturing operation, from the processes employed down to the very tools and equipment used.

NOT JUST AIRLINERS

The A400M represents a true diversification into the military market for Airbus, being the world's most modern military transport aircraft currently in production. It features the first ever composite (carbon fibre reinforced plastic) wing-box on any Airbus aircraft, produced in the new £70 million (€100 million) wing centre that is equipped with state-of-the-art jigs and tools and automated machinery including high-precision automated drilling equipment. Wing-box construction consists of pre-assembled leading and trailing edges made of composite spars, metallic ribs and 66ft (20m) long composite wing skins with integrated stringers. After assembly, the wings are fully equipped with hydraulic, pneumatic, fuel and electrical systems, fitted with flying control services and fully tested before being dispatched from Filton in the specially developed Airbus A300-600 ST 'Beluga' to the A400M final assembly line in Seville, Spain.

This major contribution to the Airbus A400M represents the latest chapter in the history of what is the country's oldest aircraft factory site, still engaged in aircraft manufacture a century after it was first established. Spanning the entire history of British aviation from the flimsy Boxkite of 1910 to the revolutionary composite wing A400M military transport of today, the centenary of the Bristol Aeroplane Company was celebrated in style in February with a ceremony at Filton when an easyJet Airbus was flown in from Bristol airport and named after its founder, Sir George White.

In recognition of 100 years of aerospace manufacturing at Bristol, easyJet named this Airbus A319 after the founder of the Bristol Aeroplane Company, Sir George White. easyJet image

From FIMA to A400M

AIR International reviews the history of Europe's new transport aircraft, the Airbus Military A400M.

The airliner-inspired all-glass cockpit comes complete with Head-Up Displays (HUD). The aircraft will also have side-stick controllers, as used on the Airbus family of airliners. AIRBUS MILITARY

The A400M story began as long ago as 1982, when the Future International Military Airlifter (FIMA) was proposed by a group comprising British Aerospace, Aérospatiale, MBB and Lockheed to develop a replacement for the Lockheed C-130 Hercules and Transall C-160 transport aircraft. Other companies joined in 1987, primarily Aeritalia (now Alenia Aermacchi) and CASA, and the project was retitled FLAEG (Future Large Aircraft Exploratory Group). However, progress was slow and in 1989 Lockheed left the consortium to develop the second-generation Hercules, the C-130J.

Now a European concern, the project was again renamed, this time as EUROFLAG (European Future Large Aircraft Group) and was formally established as a limited liability company in Rome in 1991. In September 1994 it was absorbed by Airbus Industrie and the programme management passed to a dedicated Airbus Military core team in Toulouse in 1995.

A European Staff Requirement was agreed, the partner nations wanting something that was larger and faster than the C-130 and C-160, with a capacity to carry loads nearly twice the weight of the current types. A four-engined turboprop aircraft was envisaged as these engines consume 20% less fuel per mission than a turbofan of equivalent power, providing the optimum combination of take-off and landing performance and fuel efficiency in the cruise. It would also need better tactical performance than the Hercules with similar capabilities on soft and short austere airfields and be multi-role – able to operate in the medical evacuation (medevac), air-to-air refuelling and special mission roles.

Early production predictions suggested up to 297 aircraft for the partner nations, but this figure has dwindled over the years to a current total of 181. In January 1999 the Airbus Future Large Aircraft (FLA) was re-named A400M. Programme management was to be undertaken by *Organisation Conjointe de Coopération en matière d'Armement* (OCCAR), the European purchasing agency representing the customers, which was formally ratified on January 28, 2001.

The UK was the first nation to commit to ordering the aircraft, announcing on May 16, 2000, that it would take 25, half of the expected acquisition. Delays in the programme had forced the Ministry of Defence to order 25 Lockheed C-130Js and lease four Boeing C-17s to cover obsolescence in the Royal Air Force C-130K fleet, of which many airframes had reached their fatigue limit. France and Germany followed on June 9, 2000, and the partner nations met at the Farnborough International Air Show on July 27 committing to an initial 225 aircraft. Contract signature had been planned, but this slipped until December 18, 2001 and was only for an initial tranche of 40 A400Ms.

Eventually the A400M programme was formally launched on May 27, 2003 with a contract signature between Airbus Military and OCCAR covering the purchase of 212 aircraft. This was quickly reduced to 180 following the withdrawal of Italy and Portugal from the programme and first flight was planned for 2008 with initial deliveries in 2009. Export orders arrived in 2004 and 2005 for eight aircraft for South Africa and four for Malaysia, bringing the total to 192.

The second prototype, MSN 2, lifts off for the first time from the Airbus facility at Seville in Spain on April 9. AIRBUS MILITARY

ABOVE: *A Europrop International TP400D engine undergoing tests in the early development phase of the programme. The propeller is the largest produced outside of Russia. The TP400-D6 will allow the A400M to cruise at Mach 0.72 at altitudes up to 40,000ft.* EUROPROP INTERNATIONAL
LEFT: *MSN 2 on the production line in Seville. The large size of the aeroplane is illustrated by the workmen.* AIRBUS MILITARY

DESIGN

Design, development, certification and production has followed that of civil Airbus aircraft – like its jetliners, the A400M is being manufactured at different sites across Europe before being delivered to the single final assembly line at Seville in Spain. Aero structure work-share is split in direct proportion to the number of aircraft ordered by each national government and has been allocated, where possible, to existing 'centres of excellence' from Airbus programmes. Germany is responsible for overall leadership on the fuselage, for manufacturing the centre fuselage and fin, and for much of the composites work, including large wing assemblies. France is in charge of overall systems integration and supplying the flight control system, nose section, rear ramp and the wing centre section. The UK has overall wing leadership and is responsible for wing assembly. Spain has the final assembly line and manufactures the tailplane. Belgium is looking after machined wing components, while Turkey provides major structural elements (including parts for the front and rear fuselage) and flight control surfaces.

Germany is the biggest customer for the A400M with 60 aircraft on order. It is planning to replace its fleet of ageing C-160D Transalls (pictured). KEY COLLECTION

The A400M is designed to both civil and military certification standards and incorporates state-of-the-art technology from Airbus civil aircraft, including the glass cockpit and side-stick controllers for the fly-by-wire flight control system. A400M pilots will enjoy head-up displays as primary flight instruments, augmented by large multi-function displays. Like the passenger jets, the A400M makes extensive use of composite materials. The wing is the largest composite structure of its type ever to be made and features the first CFRP (carbon fibre reinforced plastic) wing-box on an Airbus-built aircraft. A six-wheel main undercarriage offers excellent soft and short-field capabilities and allows the aircraft to be flown from short, unpaved airfields with as little as 3,280ft (1,000m) of usable runway. Its small turning radius and ability to reverse (even up a 2% slope) allows it to operate from confined aprons and taxiways. The 74ft 4in (22.65m)-long cargo hold is 13ft 1in (4.00m) wide at floor level and 12ft 7in (3.85m) high, and can carry up to six tons of payload, large enough to accommodate up to 116 fully equipped troops or paratroops, seated in four fore-and-aft rows, or up to 66 stretchers with 25 attendants. Possible loads include up to six Land Rovers and trailers, two Boeing AH-64 Apache or Eurocopter Tiger attack helicopters, or two five-ton trucks and two 105mm guns.

Key to the A400M's performance capabilities are its four Europrop International TP400-D6 three-shaft 11,000shp (8,206kW) engines, which are powerful enough to give a cruising speed of Mach 0.72 at altitudes of up to 40,000ft (12,190m). The engines drive eight-bladed Ratier-Figeac FH386 propellers, one of the largest airscrews in the world, with a diameter of 17ft 6in (5.34m) specially designed to handle the very high

In its early days the project was known as FLA (Future Large Aircraft). AIRBUS MILITARY

ABOVE: ***Airbus workers and dignitaries celebrate the first flight of the prototype MSN 1 at Seville on December 11, 2009.*** AIRBUS MILITARY

power produced by the A400M's engines.

It was the engines that would delay the flight test programme – Airbus Military did not have control software for the Full Authority Digital Engine (or Electronics) Control (FADEC) system ready, and it wasn't until December 2008 that the first engine flew on a specially-modified C-130 Hercules from Marshall Aerospace's Cambridge facility.

AIRBORNE!

On December 11, 2009 at 10:15am and in front of 1,000 invited guests and media representatives, the first A400M took off from Seville's San Pablo Airport for this military airlifter's much-delayed maiden flight. Initially things did not go smoothly as the aircraft was held at the runway holding point for 15 minutes as some computers used for flight test instrumentation had to be reset once, and in some cases twice. Fortunately this hurdle would not have prevented the flight from taking place, it would simply have meant that less data would have been collected.

A400M F-WWMT, MSN (Manufacturer's Serial Number) 1 lifted off from Runway 09 and stayed airborne for 3hrs 47mins, operating over the south-west of Spain. While aloft, the flight envelope was explored in a wide speed range and the crew tested lowering and raising the landing gear and high-lift devices at altitude.

The A400M's performance in landing configuration was also examined. The aircraft mainly flew between 8,000 and 10,000ft (2,400 – 3,000m), though was taken up to 18,000ft (5,500m) for a pressurisation test. It also reached the type's top speed of 300kts (555km/h). The Europrop International TP400D engines are said to have performed as expected. The crew for this historic occasion comprised Edward 'Ed' Strongman, Airbus Military's Chief Test Pilot who captained the flight, while in the right-hand seat was Ignacio 'Nacho' Lombo, Experimental Test Pilot. Three Senior Flight Test Engineers were onboard: Jean-Philippe Cottet, who had responsibility for the engines; Eric Isorce looked after the aircraft systems and performance, while Didier Ronceray was assigned to monitor the handling qualities. Completing the crew was Test Flight Engineer Gerard Leskerpit. Teams of engineers in Toulouse, France and in Seville also scrutinised telemetry while the aircraft was in flight to monitor its performance.

On landing, the crew was met by King Juan Carlos I of Spain. Ed Strongman reflected: "We have had a very successful first flight – the take-off performance was impressive, we explored a lot of the flight envelope, and it was a delight to operate in such a well-designed cockpit with its easy interface to all the normal and military systems."

'Nacho' Lombo added: "From the very beginning of the flight we were impressed by the ease of handling the aircraft, which was in line with what we had experienced in the simulator. The aircraft, systems and engine performance were highly satisfactory."

The aircraft had been handed over to the flight test department on November 12, 2009 and leading up to

MSN 1 takes off for the first time on December 11, 2009. AIRBUS MILITARY

TESTING TIMES

MSN 1 has been joined by MSN 2, and then MSN 3, followed by MSN 4 before the end of the year. A fifth aircraft, MSN 6, will enter the programme during 2011 and will be the first example built to production standard. MSN 1, 3 and 6 will be based in Toulouse, while MSN 2 and 4 will be in Seville. MSN 5 was due to be used for tests as well, but as it would only have been available for the last six months of the campaign it was decided to suspend its construction because the company wanted to have the final aircraft in the flight test programme to be equivalent to subsequent production aircraft. This will also allow improvements that result from the first year of flight test to be integrated on the aircraft.

MSN 1 and MSN 2 together on the apron at Seville in February. AIRBUS MILITARY

Airbus workers spell out their future in style! AIRBUS MILITARY

ABOVE: ***The propellers of the A400M's TP400D engines spin in opposite directions on each wing to balance out the rotational forces in flight.*** AIRBUS MILITARY

the maiden flight it had been extensively tested with the engines being run at full power, and the electrical systems and on-board data network checked. It moved under its own power for the first time on November 23 – numerous taxi runs followed at progressively higher speeds, culminating in a rejected take-off at 123kts (227km/h) on December 8.

A400M will undergo civilian European Aviation Safety Agency (EASA) type certification, a requirement of customer nations at contract signature as there was no joint European military certification body. Consequently, civil certification will provide the basis upon which each nation can add its own military elements. EASA and military certification and Initial Operating Capability (IOC) is planned for the end of 2011 after completing 2,800 flight test hours – 1,900 for civil work and 900 for military requirements. Up to entry into service in late 2012 a further 400 and 500 hours will be flown for civil and military purposes for fine-tuning equipment as well as operational and military systems demonstrations. Another 670 flight test hours are planned for detailed military equipment certification.

A variety of locations will be visited to test the aircraft in demanding conditions, likely to include Keflavik, Iceland for crosswind testing; Iqualuit and Goose Bay in Canada, Thule in Greenland and Kiruna in Sweden for cold weather work; Al Ain in the UAE and Cayenne in Guyana for hot weather operations; La Paz in Bolivia and Zacatecas in Mexico for trials from airfields high above sea level and Tozeur in Tunisia for sandy conditions. A number of facilities will also be used throughout the partner nations for operational tests, for example flying from rough runways and to trial defensive aids.

MSN 1 conducted a second flight on December 22, 2009, lasting 3hrs 10mins. During this time the aircraft was able to clear the entire normal flight envelope and operated at an altitude of 30,000ft (9,144m), allowing its systems to be tested in cruise conditions. A third flight took place on January 7, 2010 lasting 2hrs 25mins, during which the aircraft was tested in different configurations.

Some A400Ms will be used in the aerial refuelling role, although it is believed that the UK MoD's three cancelled aircraft are the proposed dedicated tankers. AIRBUS MILITARY

Aerial shot of MSN 1 highlighting the curved propeller tips and the bulk of the aeroplane. Airbus Military 14_Farn_A400M: Airbus Military's flight test crew Edward 'Ed' Strongman and Ignacio 'Nacho' Lombo celebrate the successful first flight on December 11, 2009. AIRBUS MILITARY

POLITICAL FOOTBALL

Because of the delay and spiralling cost, in early 2010 the A400M was the focus of fierce debate amongst economists and politicians. Some called for its cancellation, while EADS, parent company of Airbus, said that it wouldn't continue at "any cost". Deadlines for decisions were demanded by both the company and partner nations. South Africa cancelled its order for eight aircraft and partner nations said they were considering drastic cuts in procurement if the price didn't come down.

In January an audit of the A400M programme by PriceWaterhouseCoopers (PWC) laid the responsibility for cost overrun at the feet of EADS. A leaked copy of the report obtained by German newspaper *Handelsblatt* stated that PWC could find no evidence of robust systems to monitor costs attributed to the A400M programme against the actual value delivered. It also said the EADS' budgeting had consistently and significantly underestimated the costs and that the main reasons for cost overruns were the technical complexity of the

Airbus Military's flight test crew Edward 'Ed' Strongman and Ignacio 'Nacho' Lombo celebrate the successful first flight on December 11, 2009. AIRBUS MILITARY

aircraft and the numerous design changes.

PWC's report suggested ways to cut costs – it said that €3.6 billion could be cut from the predicted €11.2 billion overspend "through management changes", but that EADS could weather the remaining €7.6 billion loss, although it would likely suffer a credit rating downgrade. It also said that cancelling the aircraft would be worse than continuing, as the resultant credit downgrade would be more severe.

In February the partner nations proposed a 'rescue plan' for the project which involved increasing the price of the contract by €2 billion and waiving all liquidated damages related to current delays, plus an additional €1.5 billion would be provided in exchange for a cut of future export sales. On March 8 EADS responded to the offer, saying that the agreement "provides a sound basis for a successful evolution of the A400M programme" and that it "will strive to identify opportunities to significantly reduce risks in the A400M programme and to deliver a state-of-the-art product within the new frame of the contract." The financial impact to EADS was an extra €1.8 billion provision for fiscal year 2009, forcing the company into the red.

On confirmation of agreement of the deal, the UK Ministry of Defence swiftly announced that the Royal Air Force will receive 22 A400M transport aircraft, a reduction of three from the original total. On April 2 the French procurement agency Direction Générale pour l'Armement (DGA) confirmed it had ordered eight CASA CN 235 light transport aircraft as a stop-gap measure until the A400M is in service with the French Air Force. The €225 million deal will see the aircraft delivered between late 2011 and mid-2013, and they will be used for light duties, taking pressure off the Armée de l'Air's fleets of larger Transall C-160 and C-130 Hercules transporters. In Germany, debate is building on the need for 60 aircraft – this order could be seriously cut.

The second pre-production A400M, MSN 2, took off from Seville for a near five-hour test flight on April 9. In the cockpit were Experimental Test Pilots Michel Gagneux and Karl-Heinz Mai, supported by Flight Test Engineers Jean-Jacques Bernard, Emiliano Requeña and Gérard Maisonneuve. MSN2 is the second of five aircraft that will undertake the 3,700 hour flight-test programme leading to first delivery. It will be primarily dedicated to aircraft and powerplant performance testing, while MSN 1 continues to be used to investigate the flight envelope, loads, flutter, and handling qualities at Toulouse in France. The third A400M is expected to fly "by the beginning of the summer".

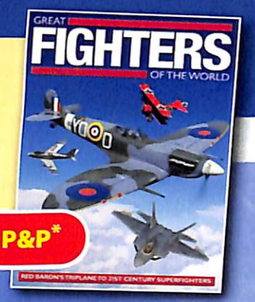
The first A400M delivery is scheduled for the French Air Force in December 2012, over three years late with the original delivery being due in November 2009. Problems with the new TP400D engines contributed to the delay, though in January 2009 Louis Gallois, Chief Executive Officer of EADS, admitted the company had underestimated the complexity of the A400M programme. The manufacturer will be hoping that the programme's troubles are behind it and that the future of the A400M will be as clear and smooth as the blue skies into which the aircraft ascended on its first flight.

COUNTRY	ORDER @ JUNE 2010
Belgium	7
France	50
Germany	60
Luxemburg	1
Malaysia	4
Spain	27
Turkey	10
UK	22
Total	181

MSN 2 joins MSN 1 on the ramp at Seville. Five aircraft will eventually comprise the test fleet. AIRBUS MILITARY

KEY PUBLISHING

Aviation Specials



Great Fighters of the World

Of all the numerous types of flying machines produced since the first days of powered flight, fighter aircraft will always capture the imagination more than any other. In *Great Fighters of the World* you'll find the amazing stories of the most famous of these awe-inspiring machines, highlighting their influence on the conflicts they fought in. 132-page, bookazine.

*UK and BFPO only, Europe £4.00, ROW £7.00

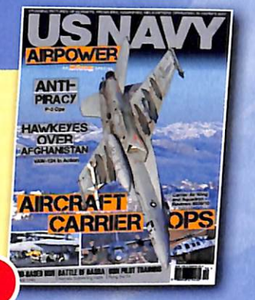
RRP £7.99 Just £4.99 + FREE P&P*

RAF Official Annual Review 2010

This 132-page special magazine provides a first-hand look at the aircraft, hardware and personnel of one of the world's premier air forces. With exclusive access to RAF stations and commanders, it offers an exclusive portrait of the service's activities in 2009 and its plans for 2010 making this special publication a must for all aviation enthusiasts and anyone with a keen interest in the modern RAF.

*UK and BFPO only, Overseas Surface £2.00, Overseas Airmail £4.50

Just £4.99 + FREE P&P*



US Navy Airpower

Wherever there has been trouble in the world, from the ongoing 'War on Terror' to face-offs against rogue nations seeking nuclear ambitions, the carriers of the US Navy have never been far off the coast, or far from the headlines. *US Navy Airpower* is a 100-page special dedicated to the US Navy's air operations from around the world.

*UK and BFPO only, Overseas Surface £2.00, Overseas Airmail £4.50

Just £4.99 + FREE P&P*

Battle of Britain 70th Anniversary

To mark the 70th Anniversary of the Battle of Britain, the editorial team at *FlyPast* have assembled ground-breaking material from renowned aviation historians and writers to pay tribute to the 'Few'. In this perfect-bound 132-page special publication the epic struggle over the fields of England during the summer of 1940 is covered in detail, using a barrage of illustrations, including specially commissioned artwork.

*UK and BFPO only, Overseas Surface £2.00, Overseas Airmail £4.50

Just £4.99 + FREE P&P*

Hurricane and RAF Salute Bundle Pack

This special 'Bundle Pack' features two of our most popular special magazines – *Hurricane* and *RAF Salute* at a special combined price! *Hurricane Salute* pays tribute to a wartime warhorse which shot down more enemy aircraft than any other during the Battle of Britain and destroyed more enemy aircraft than any other allied fighter during World War Two. *RAF Salute* pays tribute to the RAF using a combination of first-hand accounts, features from leading aviation writers, plus archive and contemporary illustrations.

*UK and BFPO only, Overseas Surface £3.00, Overseas Airmail £6.00

Just £7.99 + FREE P&P*

356/10

Order online at www.keypublishing.com/shop or

Call UK: 01780 480404 • Overseas: +44 1780 480 404

*Discount not available for Bundle Pack

SUBSCRIBERS CALL FOR YOUR SPECIALS' DISCOUNT*

Exhibitors' List

KEY H = HALL OE = OUTDOOR EXHIBITOR SZ = SPACE ZONE

This section provides details of all the exhibitors attending the Farnborough International Airshow 2010, including their stand numbers, hall or outside chalet number. Plans of the exhibition halls can be found on pages 96 to 98 and the site map can be found on page 5. All details were correct at the time of going to press.

Exhibitor Name ..... Stand Location

2 Excel Aviation ..... Chalet: B27
3 Marcos Welding H4/E3
3T RPD H4/C6
5 Star Cases Limited H3/B11
A & G Precision and Sons H1/D14
A C T Aerospace ..... H3/A3 - 4
A J Walter Aviation ..... Aircraft Display
A.E. Petsche Co H1/C8a
A.I.A.D. and MoD ITALY H1/D16e
A|D|S ..... H1/B15 & B21, Chalet: B28 - 36
A|D|S & MOD Engagement Zone H3/B13
AAI Corporation H2/A16
Aalberts Industries Defence Technologies H3/C2
AAXICO Technical Services H3/B20, H3/B21
AB Electronic Ltd H1/D10
Abu Dhabi Aircraft Technologies H4/D9
Academician Pilyugin Center H1/E10
ACB H1/A15
Accenture ..... Chalet: J4 - 10, Room 3
Access Intelligence, LLC H1/A22
Acrosoma ..... H1/A13 - A14
Action Aviation ..... Aircraft Display
Active Sensors H3/C15
Active Space Technologies H4/E3
Activity Information Management Ltd H1/B15
ADSE H3/C2
Advanced Composites Group (ACG) H1/A12
Advanced UAV Technology Ltd H4/FT3
Advantage Aviation Affairs Ltd ..... Aircraft Display
AEM Limited - AMETEK MRO H1/B5
Aerazur - Zodiac Aerospace H1/A15
Aerea S.p.A H1/D18
Aerial Surveillance Systems, Inc. H3/D20
Aero Gear Inc H2/B16
Aero Quality Sales H4/F2
Aero Sekur Ltd H4/B8
Aero Sense Technologies H3/C10
Aero Trade a.s. H3/B31
AERO Vodochody a.s. H3/B31
AeroCision LLC H2/B16
Aerodyne Alloys H4/D5
Aerofina S.A. H3/B30
Aerojet ..... Chalet: C4 - 5
Aeromet International plc H1/B15
Aeronamic B.V. H3/C2
Aeronautical Accessories, Inc. ..... Chalet: L3 - 7
Aeronautical Systems, Inc. H2/A23
Aeropair Limited H1/B19
Aeropeople Limited H4/A11
Aeropolis, Parque Tecnologico Aerospacial de Andalucia H4/E1
Aeroports de Montreal H4/C17b
Aeroriel SA CV H4/FT17
Aero-Safe Devices H4/C18
Aerosertec H4/E1
Aerospace & Security Media H1/B18
Aerospace Alloys, Inc. H2/B16
Aerospace and Defence Knowledge Transfer Network H1/B12a
Aerospace Dynamics International H2/A12
Aerospace Industries Association (AIA) ..... Chalet: K5 - 6
Aerospace Industries Association of Canada (AIAC) ..... H4/C17 - C20
Aerospace Logistics Ltd H2/C8
Aerospace Manufacturing Magazine H1/B2
Aerospace Metal Finishers Ltd H1/B13
Aerospace Missions Corporation H2/B8
Aerospace Optics, Inc. H2/C32
Aerospace Products International (API) H3/D13
Aerospace Tooling Limited H1/B19
Aerospace Turbine Rotables H3/D13
Aerospace Wales H1/B17
Aerostar S.A. H3/B30
Aerotech Peissenberg GmbH & Co. KG H4/E9i
Aeryon Labs Inc. H4/FT10
AESIR Ltd H3/B28b
AF Aerospace H4/F13
Agat MRI Jsc. H1/D15
AGC Incorporated H2/B16
Agent Oriented Software Limited H1/B15
Agenzia Spaziale Italiana H3/SZA
Agility Fairs & Events Logistics Ltd H1/B15
AgustaWestland ..... OE1 & OE2
aicep Portugal Global H4/E3
AIN's Farnborough Airshow News H4/D1a
Air & Marine Products Ltd H3/C14
Air and Ground Ltd H1/A17
Air Cadets H1/E6
Air Data Inc. H4/C17b
Air Industries Company (AIC) H4/F13
AIR International Magazine H1/C1
Air League - Leading Edge, The Futures Day, Panorama B/27
Air Liquide H1/A15
Air Parts Ltd H1/D3
Air Service Training Limited H1/B19
Air Tractor, Inc ..... Aircraft Display
Air Traffic Management H1/C1
Air Transport World H3/D5
Airborne Technologies H3/C19
Airbus ..... Chalet: P6
Airbus Military ..... H4/G12, Chalet: C24 - 26 & D4 - 8, OE21
Aircelle ..... H4/B12, Chalet: C6
Aircraft Engineering Concern, Joint Stock Company (JSC) H1/D17
Aircraft Hinge, Inc. H2/A22
Aircraft Industries, a.s. H3/B31
Aircraft Lighting International H3/A10a
Aircraft Philipp GmbH & Co KG H4/E9h
Aircraft Research Association Ltd H3/C18
Aircraft Service International Group H4/F15
Airdrome Precision Components H4/F13
Airfasco Industries H2/B30
AirForces Intelligence H1/C1
AirForces Monthly H1/C1
Airliner World H1/C1
Airmod Consulting H2/C28
Airports International H1/C1
Airports of the World H1/C1
Akaer H2/C28
AKITA SEIKO CO., LTD. ..... Chalet: C30
Al Jundi Journal - MOD - UAE H2/C30
Alabama Development Office H3/B22b
Alabama Power Company H3/B22b
Alabama State Port Authority H3/B22b
Albany Engineered Composites H2/B31
Alberta Ministry of International and Intergovernmental Relations H4/C19d
Alcan Global Aerospace H3/B26a
Alcoa Aerospace H1/A9
Alcoa Fastening Systems H1/A9
Alcoa Forgings and Extrusions H1/A9
Alcoa Global Rolled Products H1/A9
Alenia Aermacchi ..... OE1 & OE2
Alenia Aeronautica S.p.A. ..... OE1 & OE2
Alestis Aerospace H4/E1
Alfa Meccanica H1/D16
ALKAN H1/A15
All Metal Services Ltd H1/D12
Allfast Fastening Systems Inc. H1/A11
Allied Maxcut Engineering H1/D11
Alloy Surfaces Company Inc. ..... H4/A12, Chalet: C29
Almadesign-Conceito e Desenvolvimento de Design, Unipessoal Lda H4/E3
Aluminium Special Products Limited H1/B14
Amari Aerospace Ltd H2/C22
AMASJ H3/D16
Ambra Solutions H2/C28
AMDI - Moroccan Investment Development Agency H4/B12a
American Turbo Systems H4/F2
Ameron - AMETEK MRO H1/B5
Amesa H4/E2
AMETEK Aerospace & Defense ..... Chalet: A19
AMETEK MRO H1/B5
AMI Metals, Inc. H3/C8
Amorim Cork Composites H4/E3
Amphenol Limited H1/B15
Amsterdam Airport Area H3/C2
Andalucia – Spain Aerospace Region H4/E1
Angelantoni Industrie SpA H4/E5
Antavia - AMETEK MRO H1/B5
Antonov Company ..... H2/C27, Chalet: B26
APM Hexseal H3/C14
Apollo Aerospace Components H4/FT9
APPH Ltd H4/F15
AQA - Quebec Aerospace Association H4/C17b
Aquarese Industrie H1/A15
ARABIAN AEROSPACE H2/C6
Arizona Department of Commerce H3/B24
ArmorWorks H3/B24
Armstrong Precision Components Ltd H3/B28
Arnold Wragg Ltd H1/A18
Arnprior Aerospace Inc. H4/C18
Arrowhead Products H2/B25
Asahi Kinzoku Kogyo Inc. ..... Chalet: C30
ASCO Industries ..... H1/A13 - A14
ASE S.r.l H1/D16c
Ashot Ashkelon Industries Ltd H4/E14
Asian Aerospace H4/D8
Associated Aircraft Mfg & Sales Inc H3/B20, H3/B21
ATI Aerospace ..... H4/G16, Chalet: C22 - 23
ATK ..... Chalet: A16
Atkins H3/C2
ATL H1/A19
Atlantic Alliance of Aerospace & Defence Associations (Atlantic Alliance) H4/C19
ATR ..... Chalet: K10 - 11
Attewell Ltd H1/B15
Aubert & Duval H1/A15
August Steinmeyer GmbH & Co. KG H4/E9f
Augusta Economic Development Authority H2/B8
Augusta Regional Airport H2/B8
Aurora Flight Sciences H3/D19c

Ausco, Inc. H2/B28
Australia - Team Australia H1/D6
Australian Department of Defence, Defence Export Unit H1/D6
Australian International Airshow 2011 ..... H1/D6
Autoclima SpA H1/D16
Autodesk Ltd H1/A4
Auvation H1/B17
AUVSI H3/D20
AvAid H1/B6
Avanti Communications Group Plc H3/SZ14
AvBuyer.com H2/C2
Avcorp Industries Inc. ..... Chalet: B12
Aviaexport Plc H1/D15
Avialec International/A KAPCO Company H1/C10
Aviall - a Boeing Company H4/G17
Aviatec H1/A15
Aviation Affairs Ltd ..... Aircraft Display
Aviation International News H4/D1a
Aviation Maintenance Magazine H1/B18
Aviation News H1/C1
Aviation Security International Magazine H1/B18
Aviation Spares & Repairs Ltd H3/C5
Aviation Week ..... H1/D13, Chalet: A20 - 21
Avibank Mfg., Inc. H4/F13
Avio Group H1/C15
Avio-Diepen H3/C2
Avion & Piloto H1/C1
Avion Revue Internacional H1/C1
Avionics Services H2/C28
AVISA Aviation Safety Systems Ltd H1/B18
Avon Magnetics H1/B16
AVspares.com H4/FT7
Avtech Corp H2/B34
AWEX (Walloon Foreign Trade & Investment Agency) ..... H1/A13 - A14
AWS Cemgraft Ltd H3/B26
AWS Electronics Group Ltd H3/B26
AWS Electronics Ltd H3/B26
AWS Jantec Ltd H3/B26
AWS Slovakia H3/B26
AYR Group Limited H3/D23

B/E Aerospace H2/C15
BAE Systems - Heritage ..... Chalet: K4
BAE Systems plc ..... FIVE
BAE Systems Regional Aircraft H1/B19
Bahrain Air H3/D10
Bahrain Airport Company H3/D10
Bahrain Airport Services H3/D10
Bahrain Duty Free Shop H3/D10
Bahrain International Airshow (BIAS) ..... Chalet: D11
Baja California State/Mexico H3/D16
BAJARS H4/FT6
BalSeal Engineering Europe BV H4/A2
Baoji Titanium Industry Co., Ltd. H4/F5
Barco ..... H1/A13 - A14
Barden Coporation (UK) Ltd, The H1/B21
Barnbrook Systems Limited H1/B18
Barnes Aerospace H4/G13
Barrett Turbine Engine Company H4/F15
Barry Controls Aerospace H3/D9
BBA Aviation plc H4/F15

BDLI - Bundesverband der Deutschen Luft- und Raumfahrtindustrie e.V. H4/E9b
Beagle Aerospace H1/B18
Beaver Aerospace & Defense, Inc H2/A18
Becker Avionics H3/C11
Beldam Crossley Limited H1/B18
Belgian Aerospace ..... H1/A13 - A14
Bell Aerospace Services Inc. ..... Chalet: L3 - 7
Bell Helicopter ..... Chalet: L3 - 7
Bell/Agusta Aerospace Company ..... Chalet: L1-2, OE22
Belotti CNC Machining Centers H1/C3
Beriev Aircraft Company H1/D15
Bespoke Training Systems Ltd ..... H3/A3 - 4
BEST-TECH Co., Ltd. ..... Chalet: C30
BHW [Components Ltd] H1/B15
Bimal s.r.l. H4/E5
Birmingham Business Alliance H3/B22b
Bisiach & Carrù SpA H1/D16
Blades, The ..... Chalet: B27
Bladon Jets H1/D10
Bloodhound Programme Ltd OE16
BOC Aviation Pte. Ltd H4/G11
Bodycote H4/G10
Boeing Company ..... Chalet: B1 - 6, OE5, OE24
Böhler Bleche GmbH & Co KG H4/D6
Böhler Edelstahl GmbH & Co KG H4/D6
Böhler Schmiedetechnik GmbH & Co KG H4/D6
Böhler-Uddeholm (UK) LTD H4/D6
Böhler-Uddeholm Corporation H4/D6
Bolton Aerospace Ltd H4/C2
Bombardier Aerospace ..... Chalet: C1 - 2
Bombardier Customer Services H1/B13
Bonetti Aircraft Supports S.P.A. Consorzi HAAS BAS Tcm - BAS UFC H1/C21
Bonnington Surveyors H3/D19b
Boone Extend/A KAPCO Company H1/C10
Bowmill Engineering Ltd H1/B16
Bradley Arant Boult Cummings LLP H3/B22b
Bralco Metals H3/A6
Breitling UK Ltd ..... H3/Breitling Champagne Bar
Breton SpA H4/A15
British Disabled Flying Association H2/C36
Britten-Norman OE13
Bromford Industries Ltd H1/B14
Brookhouse, Ltd. – Kaman Composites ..... Chalet: C4 - 5
Brush Wellman Ltd H1/A7
BSI H1/C16
Bulwell Precision Engineers Ltd H4/A9
Busby Metals Ltd H1/A7

C C T Limited H1/B18
C DUGARD LTD H4/A6
C. R. Onsrud Inc. H3/B19
CAAFI H3/A9a
CAB H4/E6
CADES H2/C4
CAE ..... Chalet: A27
Caetano Components S.A. H4/E3
Caledonian Airborne Systems H3/C12
Calspan Corporation H3/A10a
Canada ..... H4/C17 - C20, Chalet: B12
Canada West Aerospace & Defence Industries Association H4/C19d

Canadian Centre for Unmanned Vehicle Systems H4/FT10
CANREP H4/C17b
Canyon Engineering Products H4/F7
Caparo Accles & Pollock H1/B21
Capital Air-Solutions H3/B20, H3/B21
Capital Avionics, Inc. H3/B20, H3/B21
Cargo Aids Ltd H4/FT18
CARUSO & FREELAND OE15
Castle Metals Aerospace H4/E2
CATIC (China National Aero-Technology Import & Export Corp) ..... H3/ B27, Chalet: A32 - 33
CAV Aerospace Ltd H1/B21
CECOMPI H2/C28
Cefival H4/B5
Cenaero ..... H1/A13 - A14
Center for Ground-Based Space Infrastructure Operation H1/E10
Centra Industries Inc. H4/C18
Centro Estero per l'Internazionalizzazione H1/D16
Cessna Aircraft Company ..... Chalet: L3 - 7
CFM International ..... H4/B13, Chalet: A22 - 23
CG Tech Ltd H1/D10
Chamber of Commerce of Huntsville/ Madison County H3/B22b
Chandler/May H3/D20
Chautauqua Industrial Development Agency .. H3/A10a
Chemring Countermeasures Ltd ..... H4/A12, Chalet: C29
Chemring Defence ..... H4/A12, Chalet: C29
Chemring Energetic Devices ..... H4/A12, Chalet: C29
Chemring Energetics UK Ltd ..... H4/A12, Chalet: C29
Chemring EOD Ltd ..... H4/A12, Chalet: C29
Chemring Group PLC ..... H4/A12, Chalet: C29
Chemring Ordnance H3/B20, H3/B21
Cherry Aerospace H4/F13
CHH CoNeX H1/B14
Chihuahua State/Mexico H3/D16
China Academy of Launch Vehicle Technology .. H3/B25
China Aviation Industrial Base H4/E16
Chinn Engineering Ltd H4/A9
Chinn Ltd H4/A9
CHUO ENGINEERING CO., LTD. ..... Chalet: C30
Cincinnati Thermal Spray Inc H4/B3
Circor Aerospace H3/C7
CIRCOR Aerospace Products Group H3/C7
Civil Aviation Affairs Kingdom of Bahrain H3/D10
Click Bond H3/D17
Cloud Cap Technology/Goodrich IRS Systems ... H3/D20
CML Group H1/D14
CMS Industries H4/FT14
CO.ME.AR s.r.l. H4/E5
Coast Composites Inc H1/B15
Cobham plc ..... H3/C9, Chalet: C15 - 17
Cohort plc H4/G9
Colledge & Morley Ltd H4/A9
Columbia Metals Ltd H4/FT5
Columbia Precision Limited H1/B14
Columbus Lowndes Development Link H2/A11
COM DEV Europe Ltd H3/SZ3
Combined Composite Technologies Limited H3/B18
Commerce Overseas Corporation H3/B19
Commercial Aircraft Corporation of China Ltd ... H3/D14
Commonwealth of Australia, Department of Innovation, Industry, Science and Research H1/D6
Competitive Global Manufacturing H3/D16
Composite Horizons Inc H1/B15
Composites Atlantic Ltd. H4/C17
Composites in Manufacturing Magazine H1/B2
Comtronic GMBH H3/C14
Consolidated Precision Products H2/A10
Consult Avila H1/B14
Contractair Ltd H4/C7
Cosworth H4/B9
Couro Azul-Industria e Com. de Couros, SA H4/E3
Crane Aerospace & Electronics H4/A21
Cranfield Aerospace Limited H1/B18
Cranfield University ...H1/B18, Futures Day, Panorama A/11, Aircraft Display
Creative Electronic Systems H1/A16
Creuzet Aeronautique & Indraero Siren H1/A15
CribMaster/Tool Clarity H4/A3
Critical Materials H4/E3
Critical Software S.A. H4/E3
Crystalaid Manufacture Pty Ltd H1/D4
CSC ..... Chalet: B23
CSC Technology and Consumer Sector ..... Chalet: B23
Cubewano Limited H1/B14
Cubic Defense Applications H3/B5
Cursor, LLC H2/B16
Custom Control Sensors, Inc. H2/B3
Cyclone Manufacturing Inc. H4/C18
Czech Trade Promotion Agency H3/B31

Daco Scientific Limited H1/B18
DAE Industries H4/C10b
Dakota Air Parts Intl., Inc. H3/B22d
Dallas Airmotive, Inc. H4/F15
Dassault Aviation ..... Chalet: J1 - 2
Dassault Systèmes H1/D14
Datron H3/D20
Davall Gears Ltd H1/B18
dBD Communications H3/D21
DCI H1/A15
De Boer Structures (UK) Ltd ..... Chalet: C18
Defence R&D Canada H4/C19c
Defence Support Group H4/A19
Defense Energy Support Center DESC H3/A9a
Defense News Media Group H2/B40
Defense Technology Equipment, Inc. H3/B22a
Delcam H1/B14
Denroy Plastics Ltd H1/B13
Derco Aerospace, Inc. H4/D10
DeTect, Inc. H3/B20, H3/B21
Deutsch H4/E19
DGA (French MoD) H1/A15
DGA Aero Engine Testing H1/A15
DGA Aeronautical Systems H1/A15
DGA Flight Testing H1/A15
DHL/DHL Express ..... IHS Jane's Business Centre
Diamond Aircraft Industries OE18
Dip. Di Ing. Industriale-Universita' Di Perugia H4/E5
Directed Energy Warfare Office, Naval Surface Warfare Center, Dahlgren Division H2/B37a
Dishon Limited H4/C18
DiSTI H3/B20, H3/B21
Ditta Scocchetti F. di M.G. Argentati H4/E5
DO Systems Ltd OE18
Doncasters Group Ltd H4/G8
Dormer Tools Ltd H1/D14
Doughty Precision Engineering Ltd H4/A9
Drake Air - AMETEK MRO H1/B5
Drallim Aerospace H4/FT18
DRS Technologies, Inc. ..... OE1 & OE2
DSEi H1/C20
Dubai Airshow 2011 ..... H4/A4
Ducommun Incorporated H2/B6
Dunlop Aircraft Tyres Limited H4/C14
DuPont Vespel H4/E18
Dutch Gas Turbine Association VGT H3/C2
DutchAero H3/C2
Dynamic Aviation Group, Inc. H2/A24
Dynatech International Corp/Military Parts Exchange LLC H3/A10a
Dytecna H1/B17

EADS ..... H4/G12, Chalet: C24 - 26 & D4 - 8, OE21
EADS Astrium ..... H3/SZB, H4/G12, Chalet: C24 - 26 & D4 - 8, OE21
EADS Composites Atlantic H2/B34
EADS Defence & Security UK ..... H4/G12, Chalet: C24 - 26 & D4 - 8, OE21
EAS Exhibition Services Inc. .. H4/C17 - C20, Chalet: B12
EAST-4D Carbon Technology GmbH H4/E9c
Eaton Aerospace Group H4/G19
Eaton Cpn H3/C14
ECE - Zodiac Aerospace H1/A15
Economic Development Council for Sonora - State of Sonora H3/B12
Economic Development Council for Tallahassee/Leon County, Inc. H3/B20, H3/B21
EDAC Technologies Corp H2/B16
Edaetech-Engenharia Tecnologia, S.A. H4/E3
EDC For Florida's Space Coast H3/B20, H3/B21
Edwards & Associates, Inc. ..... Chalet: L3 - 7
Efaflex H3/B25a
EgyptAir H2/B11
Elbit Systems Ltd H1/C14
Electroimpact UK Ltd H1/B17
Electromech Technologies H4/F2
Electronic Apparatus NV ..... H1/A13 - A14
Elettronica H1/C13
Elettronica Aster SpA H4/D7
Elizabeth City State University H3/B19
Elsag Datamat spa ..... OE1 & OE2
Embassy of the United States H2/B33a
Embraer ..... Chalet: A17 - 18
Embry-Riddle Aeronautical University . H3/B20, H3/B21
EMPORDEF-Empresa Portuguesa de Defesa, SGPS, SA H4/E3
EMS Aviation H4/C10c
ENCORE H4/F2
Enerdyne H3/D20
Engine Alliance H4/A10
Enhance RPO H1/B16
Enterprise Florida H3/B20, H3/B21
Environmental Tectonics Corporation H2/B36
EOS Electro Optical Systems Ltd H4/C6
Epicor Software (UK) Ltd H1/B21
ERA Electronic Systems S.r.l. H4/E5
ESCO Turbine Technologies ..... H1/A13 - A14
ESPA-LJF Stillman - JPR H3/D9
ESRI Portugal, S.A. H4/E3
Essex Cryogenics of Missouri H2/A1
Essex Industries, Inc. H2/A1

Essex Industries, Inc. Mfg. Div H2/A1
Essex PB&R Corporation H2/A1
Esterline H1/B11
Esterline Advanced Sensors H1/B11
Esterline Avionics Systems H1/B11
Esterline CMC Electronics H4/C17a
Esterline Communication Systems H1/B11
Esterline Control Systems H1/B11
Esterline Defense Technologies H1/B11
Esterline Engineered Materials H1/B11
Esterline Power Systems H1/B11
Esterline Sensors Services H1/B11
Euramec ..... H1/A13 - A14
EUREP Industries H1/A15
Eurocopter ..... H4/G12, Chalet: C24 - 26 & D4 - 8, OE21
Eurofighter GmbH ..... Chalet: A34 - 35, OE12
EUROJET Turbo GmbH ..... Chalet: A36
Europe Aviation H1/A15
European Centre for Aerospace Training H1/D11
European Space Agency H3/SZD
European Unmanned Systems Centre (EuroUSC™) H3/D19a
Evolve Space Solutions Lda H4/E3
Exameca SA H1/A15
Excalibur Systems H2/C20
Executive Beechcraft Inc H4/F15
Export Group for Aerospace and Defence H1/B21

F & E Aerospace H4/A4
Failsafe GPU OE25
FanWing H1/B18
Farnborough Aerospace Consortium H1/B18
Farnborough Aircraft Interiors ..... H3/A3 - 4
Farnborough International Ltd ..... ShowCentre
Farsound Engineering Limited H1/E1
Fastavia Ltd H3/D17
Fatigue Technology H4/F13
FAUN Trackway H1/B17
Federal Enterprise Lavochkin Association H1/E10
Federal Space Agency (Roscosmos) H1/E10
FERCHAU UK H1/B16
Ferra Engineering Pty Ltd H1/D4
Ferranti Technologies Limited H1/C22
Fibracon-Insoll:Machined Plastics H4/E18
FIDAE 2012 ..... H3/D3
Fidia SpA H1/D16
Field Aviation H4/C20
Figeac-Aero H1/A20
Finmeccanica ..... OE1 & OE2
Firetrace Aerospace H3/B24
First Aviation Services Inc. H3/D13
First Partnership Limited H1/E17
Firth Rixson Limited H4/E13
FIVE (Farnborough International Venue and Events) ..... ShowCentre
FLAG (Flemish Aerospace Group) ..... H1/A13 - A14
Flame Enterprises Inc H3/C14
Flanagan Industries H2/B16
Flanders Investment & Trade ..... H1/A13 - A14
Flight Test Centre of Excellence H4/C18
Flightglobal ..... Chalet: A25 - 26
FLIR Systems Ltd. ..... Chalet: C4 - 5
Florida Center For Advanced Aero-Propulsion H3/B20, H3/B21
Florida's Great Northwest H3/B20, H3/B21
Fluid Forming Technologies H2/B5
Flybe Training Academy H1/B16
Flyby srl H1/D16
FlyPast H1/C1
FN Herstal ..... H1/A13 - A14
Fokker Aerospace Group H3/C2
Fonds de Solidarite FTQ H4/C17b
Fooke GmbH H4/E9j
Ford Aerospace Ltd H1/D14
Forecast International H1/D1
FOREST-LINÉ Industries H1/A15
FP Soudage H1/A15
Fratelli Canalicchio S.p.A. H4/E5
Freudenberg Simrit LP H4/C13
Frisa Aerospace H3/D16
FSL Aerospace Ltd H4/B2
FUCHS Lubricants H4/FT8
Fucine Umbre H4/E5
Fuji Heavy Industries Ltd H2/C17
Fundacion Hélice H4/E1

G & O Springs Ltd H1/B14
G Bopp & Co Ltd H2/C18
GA Buyer Europe H2/C2
Gardner Aerospace - Basildon Limited H2/C16
Gardner Aerospace - Broughton Limited H2/C16
Gardner Aerospace - Burnley Limited H2/C16
Gardner Aerospace - Hull Limited H2/C16
Gardner Aerospace - Ilkeston Limited H2/C16
Gardner Aerospace - Wales Limited H2/C16
Gardner Aerospace Mielec Sp. z o.o. H2/C16
Gardner Group Limited H2/C16
Gardner Poland SP.zo.o H2/C16
Garlock Sealing Technologies H4/E12
Garofoli S.p.A. H4/E5
GasTOPS H4/C18
Gazprombank (Open Joint-Stock Company) H1/E11
GE Aviation ..... H4/B7, Chalet: P1 - 5
GE Sensing & Inspection Technologies H1/C8
GEB Ltd H4/A9
GEDORE Tool Center KG H1/C2
Gemelli SpA H1/D16d
General Atomics Aeronautical Systems, Inc. H2/A9
General Dynamics Armament and Technical Products, Inc. ..... Chalet: C4 - 5
General Dynamics UK Limited ..... Chalet: B18
General Plastics Manufacturing Co. H2/B34
Geotest - Marvin Test Systems, Inc. H2/A12
Ghenova Ingenieria Aeronáutica H4/E1
GIFAS ..... H1/A15 & H1/A20
GIMAS - Moroccan Aeronautical and Space Industries Group H4/B12a
GKN Aerospace ..... Chalet: G1 - 3
Gladstone Aerospace Corporation H4/C18
Global Aerosystems, LLC H2/B34
Global Tooling Systems Inc H1/B15
GlobalVantage H3/D16
Globo Usinagem H2/C28
GM&T International 2000 S.A. H3/B30
GMT - Kep Metal Tech H4/G2
GMT Rubber-Metal-Technic Ltd H2/B41
GMVIS Skysoft, S.A. H4/E3
Goodrich OE4
Gore & Associates H2/C21
Gould Alloys H1/B14
Government of Ontario H4/C18
Government of Canada H4/C17
Government of Manitoba H4/C19d
Government of the State of Nuevo Leon H3/D16
Greater Jackson Alliance H2/A11
Greater Wichita EDC H3/A10
Greene, Tweed & Co H4/E8a
Group Rhodes H1/D11
Groveley Engineering Precision Ltd H1/B16
Grupo Moldoeste H4/E3
Grupul Industriei Aeronautice Romane (GIAR) S.A. H3/B30
Guanajuato State/Mexico H3/D16
Gulf Air H3/D10
Gyeongsangnam-do Province H3/D22
Gyrojet Ltd H4/A17

H.T.C. S.p.A. High Technology Center H4/E5
H+S Aviation Ltd H4/F15
Hamilton Sundstrand, a United Technologies Company ..... H3/B25e, Chalet: D14 - 16
Hampson Aerospace Services Ltd H1/B15
Handtmann A-Punkt Automation GmbH H4/E9a
Hanyuda Co., Ltd. ..... Chalet: C30
HARCO H2/B4
Hard Lock Industry Co., Ltd ..... Chalet: C30
Hartwell Corporation H4/F2
HASCO H4/F2
Haskell Company, The H3/B20, H3/B21
Hawker Beechcraft Corporation ..... Chalet: J3
HCL Technologies Ltd H2/C10
Heat Treatment Australia H1/D4
HEICO H3/D8
Helicopter Association International H2/B27
Heli-One Canada Inc. H4/B9a
Helisota Ltd H1/C18
Heller Machine Tools Ltd H4/A22
Helmet Integrated Systems Ltd H3/D18
HEMAQ H3/D16
Henderson County Partnership for Economic Development H3/B19
Henton Engineering Ltd H4/A9
Héroux Devtek Inc. ..... Chalet: B12
Hewlett-Packard Co. ..... SkyView Restaurant - Hall 1a
Hexadyne Corporation ..... Chalet: C4 - 5
HG Aerospace Engineering Ltd H4/A6
High Standard Aviation - AMETEK MRO H1/B5
High-Performance Materials Institute .. H3/B20, H3/B21
Hindustan Aeronautics Limited ..... Chalet: K14
Hispano-Suiza ..... H4/B12, Chalet: C6
HISS, Inc. H4/C18
HITCO Carbon Composites, Inc. H4/C11
Holos, S.A. H4/E3
Honeywell's UOP H3/A9a
Hubei Hudiequan Plastic Products Co. Ltd H1/A1
Huntsville International Airport H3/B22b
Hurst Green Plastics Ltd H1/D10
Hutchinson Aerospace H3/D9
Hyde Aero Products Ltd H1/D10
Hyde Group Engineering Ltd H1/D10
Hydra-Electric Co. H3/B22
Hydra Technologies H3/D16
Hydrapower Dynamics Engineering Ltd H1/B14
HYDRO Systems H4/G3

I.S.T. Corporation ..... Chalet: C30
IAI - Israel Aerospace Industries ..... Chalet: A29, OE20
IAR S.A. Brasov H3/B30
IAROM S.A. H3/B30
Iberomoldes, S.A. H4/E3
IBM (UK) Ltd OE7
ICE Corporation H2/C3
ICE Ufficio Regionale Dell'Umbria H4/E5
Icon Polymer Limited H1/B14
Icore - Zodiac Aerospace H1/A15
IDMEC-IST H4/E3
IEC Engineering Ltd H4/A9
IFP H1/A20
IFS Defence Ltd H1/B15
IHI Aerospace Co.,LTD H2/C17
IHI Corporation H2/C17
IHS Global Insight ..... IHS Jane's Business Centre
IHS Global Ltd ..... IHS Jane's Business Centre
IHS Jane's ..... IHS Jane's Business Centre
Ilyushin Aviation Complex H1/E7
Ilyushin Finance Co. H3/C3
Imai Aero-Equipment Mfg. Co., Ltd. (IAC) ..... Chalet: C30
IML H2/C29
Incompol-Indústria de Componentes, S.A. H4/E3
Independent Forgings & Alloys Ltd H1/B10
Industrial Development Commission of Mexicali H3/D16
Industrial Metals International Limited H2/C29
Inegi-Instituto de Engenharia Mecânica e Gestão Industrial H4/E3
INEO ORRMA H1/E1
Infinity Air Inc H2/A6
Infotech Enterprises GmbH H4/G7
Innovative Materials Technologies Inc. H4/C17b
Innovative Solutions and Support, Inc. H3/B17
Insoll-Fibracon:Machined Plastics H4/E18
Institutul National de Cercetare-Dezvoltare TURBOMOTOARE COMOTI H3/B30
Institutul National de Cercetari Aerospatiale ELIE CARAFOLI INCAS H3/B30
International Aero Engines ..... H4/G18, Chalet: B20 - 21
International Governor Service, LLC H4/F15
International Turbine Service H4/F15
Inter-Tec Services Ltd H1/B19

Intespace H1/A15
Inventory Locator Service LLC H1/C4
IPI Solutions Limited H1/B14
IRKUT Corporation ..... H1/E8, Chalet: B10 - 11, OE14
ISG Prognostica H4/C18
Isle of Man Aerospace Cluster H1/D10
Isomura Industrial Co., Ltd ..... Chalet: C30
Isq-Instituto de Soldadura e Qualidade H4/E3
Italian Trade Commission H4/E5
ITT Corporation ..... H3/A8, Chalet: A24a
iXMotion H1/A15

Jabil H1/B19
Jabil Defense & Aerospace H2/A9b
Jacksonville Aviation Authority H3/B20, H3/B21
Jacksonville Economic Development Commission H3/B20, H3/B21
Jacksonville Regional Chamber of Commerce H3/B20, H3/B21
Jalisco State/Mexico H3/D16
JALUX Inc H2/C19
Jane's ..... IHS Jane's Business Centre
Japan Aerospace Industry Forum ..... Chalet: C30
JARA H3/B10
JASPA CO.,LTD ..... H2/C17, Chalet: C30
JBT AeroTech H3/B20, H3/B21
Jehier H3/D9
Jet International Co LLC H2/A2
Jetcraft Avionics, LLC H2/B8
JF Faber Limited H1/D11
JHC MOD ..... Aircraft Display
Jihlavan a.s. H3/B31
Jihostroj a.s. H3/B31
JNDC Limited H1/B18
John Huddleston Engineering Ltd. H1/B13
Joint Stock Company "State Machine Building Design Bureau "Vympel" by name I.I. Toropov" H1/D17
JSC Academician M.F. Reshetnev Information Satellite Sistems H1/E10
JSC NPO Nauka H1/E2
JSC UAC-TA H1/E7
JSC VSMPO-AVISMA Corporation H1/D17

Kaji Metal Industries Co., Ltd ..... Chalet: C30
Kallman Worldwide, Inc. ..... H2/B32, Chalet: C4 - 5
Kaman Aerospace Group ..... H3/B18, Chalet: C4 - 5
Kaman Aerostructures ..... H3/B18, Chalet: C4 - 5
Kaman Composites ..... H3/B18, Chalet: C4 - 5
Kaman Helicopters ..... H3/B18, Chalet: C4 - 5
Kaman Precision Products ..... H3/B18, Chalet: C4 - 5
KAMATICS Corp ..... H3/B18, Chalet: C4 - 5
Kamijima Heat Treatment Co., Ltd. ..... Chalet: C30
Kaneko Manufacturing Co., Ltd. ..... Chalet: C30
Kansas Department of Commerce H3/A10
KAPCO H1/C10
Kawasaki Heavy Industries, Ltd H2/C17
KDC Group H1/B16
KDC Projects H1/B16
KDC Resource H1/B16
Kedeg Company H4/G17
Kellstrom Industries H3/A11
Kembrey Wiring Systems Ltd H1/B29
Kenko Seiki Works Co., Ltd (Aerospace IIDA) Chalet: C30

Key Publishing H1/C1
KHBO - VLOC Campus Oostende ..... H1/A13 - A14
Khrunichev State Research and Production Space Center (KhSC) – Federal State Unitary Enterprise H1/E10
Kikuchi Gear Co., Ltd (Sales Agent: JALUX,Inc.) ..... Chalet: C30
Kilfrost Group PLC H4/G5
Kilgore Flares Company LLC ..... H4/A12, Chalet: C29
Kilgour Industries Ltd H1/D11
Kinch Aviation Services H3/A3-4
King & Fowler Polska Sp z o.o. H1/B13
King & Fowler UK Ltd. H1/B13
Kingston University H1/B18
Kish Free Zone Organization - Iran Air Show 2010 ..... H1/B9
Kitamura Machinery Co., Ltd ..... Chalet: C30
Kitco Defense H3/B2
KK Precision Inc. H4/C18
Klinger Limited H4/FT2
Kobe Steel Ltd., Daian Plant ..... Chalet: C30
Korea Aerospace Industries Association H3/D4
Korea Aerospace Industries, LTD H3/D15
Koss Aerospace H4/C18
Kreisler Manufacturing Corporation H3/B1
Kristaltek-Laser e Mecânica de Precisão Lda H4/E3
KUKA Aerospace Group H4/B10
Kulite Semiconductor Products Inc H1/A10

L.M.A. - Lavorazioni Meccaniche per l'Aeronautica H1/D16
L.N. - Moldes Lda H4/E3
L-3 Communications Corp. ..... H4/F14, Chalet: A9 - 14
Labinal ..... H4/B12, Chalet: C6
Lacroix Defence & Security H1/A15
Land Rover OE26
Lanmar H2/C28
Lee Products Limited H4/F7
Leistritz Advanced Turbine Components H4/E9d
Leistritz Turbinenkomponenten Remscheid GmbH H4/E9d
Leistritz Turbomaschinen Technik GmbH H4/E9d
LFD Ltd H2/C11
Liburdi Turbine Services Inc. H4/C18
Licensed Carriage Hire Ltd (LCH) & Platinum Assist Ltd ..... Car Park 1
Linread Northbridge H4/F2
Linread Northbridge Leicester H4/F2
Liquip International - Beta Fluid Systems H3/B19
Lismolde Group H4/E3
LMI Aerospace, Inc ..... Chalet: C4 - 5
LOADMASTERS LTD H1/B18
Lockheed Martin Corporation ..... Chalet: D9 - 10, OE8
Logic Sistemi Avionici H1/D16b
Logica H3/SZ12
Loos & Co Inc H3/B20, H3/B21
LORD Corporation ..... Chalet: C4 - 5
Luciad ..... H1/A13 - A14
Luma Technologies LLC H3/B28
Lumen H4/C18

Maastricht Maintenance Boulevard H3/C2
Macclesfield College H1/D11
Mach Aéro H1/A15
Maeda Shell Service Co., Ltd. ..... Chalet: C30
Magellan Aerospace H4/C18a
Magna Parva H4/A20
Makino ..... H4/A14, Chalet: C4 - 5
Makino Europe GmbH ..... H4/A14, Chalet: C4 - 5
Makino Milling Machine Co. Ltd. H4/A14, Chalet: C4 - 5
Makino NCMT ..... H4/A14, Chalet: C4 - 5
MAN H1/B14
Manoir Industries/Manoir Aerospace H1/A15
Manufacture Francaise de Pneumatiques Michelin (MFPM) H1/C11
Manufacturing Technologies Association, The H1/B4
Mapal Ltd H1/D11
Mark Jefferies Air Displays ..... Aircraft Display
Marotta Controls, Inc. H2/A13
Marshall Aerospace Limited H4/A11
Marshall Land Systems H4/A11
Marshall Slingsby Advanced Composites H4/A11
Martek Power H3/C14
Martin Aerospace Ltd H1/B19
Martin-Baker Aircraft Company Ltd. H4/C15, Chalet: A8
Marvin Engineering Co., Inc H2/A12
Marvin Group H2/A12
MASS H4/G9
Massucato H2/C28
Master Automation Group Oy H1/D11
Materials Solutions H4/C6
MATSUDA KAKO CO., LTD. ..... Chalet: C30
Matsumoto Machine Co., Ltd ..... Chalet: C30
Matt Black Systems H1/B3
maxon motor uk ltd H1/B18
Maycast-Nokes Precision Engineering Ltd H4/E15
Maydown Precision Engineering H1/B13
MB Aerospace Holdings Ltd H1/D10
MBDA OE10
McKechnie Aerospace Group H4/F2
McTurbine, Inc. ..... Chalet: L3 - 7
MDA Space & Robotics Ltd H3/SZ2
MEAC (Middle East Aerospace Consortium) H1/B18
MEBA 2010 ..... H4/A4
Mecachrome Canada H4/C17b
Meggitt Aircraft Braking Systems ..... Chalet: C13 - 14
Meggitt Avionics ..... Chalet: C13 - 14
Meggitt Control Systems ..... Chalet: C13 - 14
Meggitt PLC ..... Chalet: C13 - 14
Meggitt Polymer and Composites ..... Chalet: C13 - 14
Meggitt Polymer Solutions ..... Chalet: C13 - 14
Meggitt Safety Systems Inc ..... Chalet: C13 - 14
Meggitt Sensing Systems ..... Chalet: C13 - 14
Mellish Precision Engineering Ltd H2/C11
Meridian Airport Authority H2/A11
Messier Services ..... H4/B12, Chalet: C6
Messier-Bugatti ..... H4/B12, Chalet: C6
Messier-Dowty ..... H4/B12, Chalet: C6
Metal Injection Mouldings Ltd H3/A5
Metals UK Ltd H4/E2
Mettis Aerospace H4/B11
MexicoNOW H3/D16
MG Sanders Company Ltd. H4/D1
Michelin Aircraft Tyres H1/C11
Micreo Limited H1/D4
Micro Spring & Presswork Ltd H1/C5
MicroPilot H4/FT15
Microtecnica H4/D11
Microtherm ..... H1/A13 - A14
Middle East Aerospace Consortium (MEAC) H1/B18
Midlands Aerospace Alliance H1/B14
MiG Russian Aircraft Corporation .. H1/E9, Chalet: B7 - 9
Military Parts Exchange LLC H3/A10a
Missiles & Space Batteries Ltd H1/B19
Mississippi Dev. Authority H2/A11
Mississippi Gulf Coast Alliance for Economic Development H2/A11
Mitsubishi Aircraft Corporation ..... Chalet: D12 - 13
Mitsubishi Heavy Industries, Ltd H2/C17
Mobile Airport Authority H3/B22b
Mobile Area Chamber of Commerce H3/B22b
MOD Defence Contracts Bulletin (MOD DCB) H1/B8
Moldes RP-Indústria de Moldes, S.U. Lda H4/E3
Mönch Publishing Group H2/B38
Moog, Inc. H4/F10
MORPHO ..... H4/B12, Chalet: C6
Morpho Detection ..... H4/B12, Chalet: C6
Morson Projects Ltd H1/D11
Moscow Design Bureau "Compas", JSC H1/E11
Motor Sich JSC H2/C23
Moyola Precision Engineering H1/B13
MPI Aviation Limited H1/B17
MPS Ltd (Metal Process Services) H4/A9
MSR Industries H3/B20, H3/B21
Mubadala Development Company ..... Chalet: C34 - 35
Muirhead Avionics - AMETEK MRO H1/B5
Mussett Aerospace H1/D11
myTECHNIC Aircraft MRO Services H4/C5

N.C.M. S.p.A. H4/E5
Nabtesco Corporation H2/C17
Nachi-Fujikoshi Corp ..... Chalet: C30
NAIDA H3/B22b
Nasmyth Group Ltd H4/A9
Nation Shield - UAE Armed Forces H3/B25d
National Aerospace Laboratory NLR H3/C2
National Bronze & Metals, Inc H2/B2
National Physical Laboratory H3/SZ13

National Research Council of Canada H4/C19c
National Technical Systems H2/B35
National Utilities Company H2/A19
Navtech, Inc. H4/C18
NDI - Northern Defence Industries H1/B18
NEAT H1/A26
NEOS s.r.l. H2/C1
Netherlands Aerospace Group H3/C2
Netherlands Industries for Defence and Security. H3/C2
New Breed Logistics H2/B29
New Chapel Electronics H1/B16
Newquay Cornwall Airport H1/B16
Nexcelle ..... H4/B12, Chalet: C6
Nicholsons Sealing Technologies Ltd H1/B15
Niigata City (c/o JALUX EUROPE LTD) ..... Chalet: C30
NIITEK Inc ..... H4/A12, Chalet: C29
Noranco Manufacturing Ltd. H4/C18
NORDAM H2/B26
Nor-Ral Inc. H2/B8
North Carolina Department of Commerce H3/B19
North Carolina's Eastern Region H3/B19
North Carolina's Global Trans Park H3/B19
North West Aerospace Alliance ..... H1/D9 - 11 & H1/D14
Northern Ireland Aerospace c/o Invest Northern Ireland H1/B13
Northrop Grumman Corporation ..... Chalet: A1 - 5, OE3, OE6
Northrop Grumman Italia S.p.A. H1/D16f
Northstar Aerospace (Canada) Inc H4/C18
Novintec H1/A15
NPP Inc. (Nasmyth Precision Products) H4/A9
NR Engineering Ltd H1/D11
Nuevo Leon State/Mexico H3/D16
NUMECA International ..... H1/A13 - A14
NWAA ASCE Programme H1/D11

Odyssey Inc H1/B15
Officine Meccaniche Aeronatiche OMA S.p.A. H4/E5
Officine Meccaniche Merendoni S.a.s H4/E5
Offsets 2000 Limited H1/B21
OGMA H4/E3
OGP UK Ltd H4/FT2
Olesa-Indústria de Moldes, S.A. H4/E3
Ontario Aerospace H4/C18
Ontic Engineering and Manufacturing Inc H4/F15
OPK Oboronprom/Oboronprom Corporation ..... H1/D17, Chalet: L9
OPIAR H3/B30
Optimal-Structural Solutions Lda H4/E3
OPTIMARE Sensorsysteme AG H4/E9g
Osborn Steel Extrusions Limited H1/D11
Ouno Creative Ltd H1/C19

P.I. Castings Ltd H3/A5
P3 ec Ltd (Group) H1/D11
Pacific Northwest Aerospace Alliance H2/B34
Pacific Scientific Aerospace H4/D12
Paic-Portuguese Aerospace Industry Consortium H4/E3
Pall Corporation H1/C12
Panavia Aircraft GmbH H4/E9e
Paramount Panels H3/B4

Paris Air Show H1/A15
Parker Aerospace H4/A18
PartsBase, Inc. H4/C10a
PartsLogistics H3/B22d
PAS Technologies H2/A25
Pattonair Ltd H1/A12
Paul Fabrications Ltd H1/B14
Paulstra SNC - Claropan H3/D9
Paulstra Vibrachoc H3/D9
PB Fasteners H4/FT4
PBS Velká Bíteš, a.s. H3/B31
PC Pilot H1/C1
PCB Piezotronics H1/A6
PCC SPS Fastener Division H4/F13
Peel Airports Group ..... H3/A3 - 4
Pemas-Portuguese Aeronautic Sector Association H4/E3
Perfect Bore Manufacturing Limited H1/B18
PFERD Tools - August Rüggeberg GmbH & Co. KG H2/C24
Philip Cornes and Co Ltd H4/D5
Piaggio Aero Industries S.p.A. H1/D20
Piedmont Propulsion Systems H3/D13
Piedmont Triad Partnership H3/B19
Pilatus Aircraft Ltd ..... Chalet: A24
Plansee Metall GmbH Thermal Management .. H4/FT13
Plansee SE H4/FT13
Plansee Tungsten Alloys H4/FT13
Plattsburgh International Airport H3/A10a
Plymouth Engineered Shapes H2/C7
Plymouth Tube Company H2/C7
Polyformes Ltd H1/D21
Polyot Research & Production Company FSUE ... H1/D15
Polytec Ltd H4/FT11
Porvair Filtration Group Ltd H4/A7
Potez Aeronautique H1/A15
PowerJet ..... H4/B12, Chalet: C6
PowerSouth Energy H3/B22b
PPG Aerospace H4/A13
Pratt & Whitney (A United Technologies Company) ..... H4/E7, Chalet: D14 - 16
Pratt & Whitney Canada H4/E7
Praxair Surface Technologies H3/D12
Precipart Corporation H4/F6
Precision Manufacturing Centre at the University of Nottingham, The H1/B14
Premier Aerospace H1/B14
Premier Turbines H4/F15
Prestel Elettronica srl H1/D16
PricewaterhouseCoopers Accountants N.V. H3/C2
Prima Industrie SpA H1/D16
Pro S3 SRL H1/D16
Production Association Urals Optical and Mechanical Plant, The H1/D17
Production Engineering Solutions Magazine H1/B2
Proespaço-Associação Portuguesa das Industrias do Espaço H4/E3
Progresstech, Ltd H1/E5
ProMexico H3/D16
PSIONdsp corp H2/C34
PTI Technologies Inc H4/G17
Purolator Facet H3/B19
PUSH (Partnership for Urban South Hampshire) H1/B18
PWS Ltd (Professional Welding Services) H4/A9

Qatar Airways ..... Chalet: C27 - 28
QFP Srl H4/E5
QinetiQ Ltd ..... Chalet: A6 - 7
QRP, Incorporated H2/A19
Quebec Government H4/C17b
Queensland Government H1/D4
Queretaro State/Mexico H3/D16
QuEST Global Pvt Ltd H2/B10

Raduga State Machine-Building Design Bureau Joint Stock Company H1/D17
Rafael Advanced Defense Systems Ltd. ..... Chalet: B19
RAL Space H3/SZ4
Rampini Carlo S.p.A. H4/E5
Raytheon Company ..... Chalet: C7 - 9, OE9, OE23
RD Taylor Ltd (Haas International) H4/F1
Reaction Engines Ltd H4/C3
Red Box International H3/C5
Redline Aviation Security Ltd ..... H3/A3 - 4
Regal Precision Engineers (Colne) Ltd H1/D11
Regione Campania - AGC 12 ..... H3/C1a
Regione Puglia - Assessorato Sviluppo Economico e Innovazione Tecnologica H3/C1
Regione Umbria - Servizio Internazionalizzazione H4/E5
Reliance Precision Limited H4/B1
Reno Machine Company, Inc. H2/B16
Resource Engineering Projects H4/C7
Resource Group Limited H4/C7
REVUE THOMMEN AG H1/A16
REXIAA Group H1/A20
Reynolds, Smith & Hills, Inc. H3/B20, H3/B21
RF Microtech S.r.l. H4/E5
RFI Corporation H3/A10a
Rheinmetall Technical Publications H1/B28
Rhinotech Computer Co., Ltd. H4/FT12
Ribermold H4/E3
Ringspann Workholding Technology H3/B25c
RIX Industries,Inc. H2/A13
RLC Engineering Group H4/F8
Robin Hood Airport Business Park, Doncaster H3/A3 - 4
Rockford Area Economic Development Council . H2/A2
Rockwell Collins ..... H4/F9, Chalet: B13 - 14
Rolled Alloys H1/D9
Rolls-Royce plc ..... H4/G15, Chalet: D1 - 3
Romaero S.A. H3/B30
Rosler UK H1/D11
Rosoboronexport Federal State Unitary Enterprise ..... H1/D17, Chalet: L8
Rostvertol PLC H1/D17
Rotor Blades Limited ..... Chalet: L3 - 7
Routledge, Taylor and Francis Group H4/B4
Royal Aeronautical Society H1/B26
RTI International Metals, Inc. ..... Chalet: K8 - 9
RUAG Schweiz AG ..... H1/A16 & H1/A24
Rufous Ltd H1/B18
Russian Helicopters, JSC H1/D17
RWG Frankenjura ..... Chalet: C4 - 5

s.com Aviation H2/C35
S.P. Korolev Rocket & Space Corporation Energia H1/E10
S3 International, LLC H4/D3
Saab AB ..... Chalet: C31 - 33
SABCA ..... H1/A13 - A14
SAE International H4/E21
Safran ..... H4/B12, Chalet: C6
Sagem ..... H4/B12, Chalet: C6
Saitek H3/A2
Samara Space Centre H1/E10
SAMTECH ..... H1/A13 - A14
Samuel Aerospace Metals H4/C17b
Sandvik Coromant UK H4/F11
Sanei-Kikai Co., Ltd ..... Chalet: C30
SANKO MFG CO., LTD. ..... Chalet: C30
SAP Media Worldwide Ltd H2/C12
Sapa Aviation Systems UK Ltd H4/A8
Sargent Aerospace & Defense H2/A7
Sarnoff Corporation H2/A4
Satair H1/C12
Sauter Bachmann AG ..... H1/A16 & H1/A24
Saywell International H3/C21
Schivo Group Ltd H4/D2
Scimitar ..... Chalet: B27
Scottish Development International H1/B19
SCOTTY Group Austria GmbH H3/C19
SEA H4/G9
SeaCast, Inc. H2/B34
Seal Dynamics H3/D8
Seaward Group H1/D11
Seco Tools H4/E10
Secondo Mona SpA H1/D16a
Seicos ..... OE1 & OE2
Select Aerospace Technologies Ltd H2/C32
SELEX Communications ..... OE1 & OE2
SELEX Galileo ..... OE1 & OE2
SELEX Service Management ..... OE1 & OE2
SELEX Sistemi Integrati ..... OE1 & OE2
SELEX Systems Integration ..... OE1 & OE2
Semta H1/B16
Senior Aerospace Absolute Manufacturing H1/C9
Senior Aerospace AMT H1/C9
Senior Aerospace Bird Bellows H1/C9
Senior Aerospace Bosman BV H1/C9
Senior Aerospace BWT H1/C9
Senior Aerospace Calorstat H1/C9
Senior Aerospace Capo Industries H1/C9
Senior Aerospace Composites H1/C9
Senior Aerospace Ermeto H1/C9
Senior Aerospace Jet Products H1/C9
Senior Aerospace Ketema H1/C9
Senior Aerospace Metal Bellows H1/C9
Senior Aerospace SSP H1/C9
Senior Aerospace Sterling Machine H1/C9
Senior plc H1/C9
Sennheiser Electronic GmbH & Co KG H4/A1
Septentrio Satellite Navigation ..... H1/A13 - A14
SGS Carbide Tool H1/B16
Shearline Precision Engineering H1/B16
Shephard Group, The H1/C6
SHINKOSHA CO., LTD. ..... Chalet: C30
Shur-Lok Company H4/F13
Shur-Lok International, S.A. H4/F13
Siemens ..... Chalet: B24 - 25
Sifco Forge Group H2/B38a
Signature Flight Support H4/F15
Signature Industries Limited - SARBE H1/A8
Sikorsky ..... Chalet: D14 - 16
Sikorsky Aerospace Services H4/D10
Silverado Cable Company, Inc H3/B24
Simtech ..... H1/A13 - A14
Singapore Airshow & Events Pte Ltd ..... Chalet: A31
Singleton PR H1/B18
SINO American Aerospace Industrial Park H3/B6
SIP ..... H1/A16 & H1/A24
Sitec Group H1/B16
Skills for Security ..... Futures Day, Panorama A/3
SkyBOOKS ..... Chalet: L3 - 7
Skywin Wallonie ..... H1/A13 - A14
SL Laser GmbH H3/D1
Smiths Advanced Metals H1/B15
Snap-on Industrial H2/A9a
Snappy Materials H2/B16
Snecma ..... H4/B12, Chalet: C6
Società Industria Meccanica S.I.ME. S.r.l. H1/D16
Society of Japanese Aerospace Companies, The H2/C17
Soder sas di Mazzanti Dino & C. sas H1/D16
SOFITEC H4/E1
Solazyme, Inc. H3/A9a
Soldiers, Sailors, Airmen and Families Association (SSAFA) - Forces Help H2/C5
Solena Group H3/A9a
Soluciones Tecnologicas H3/D16
Sonaca ..... H1/A13 - A14
Sonfarrel Inc. H3/B22c
Sonora State/Mexico H3/D16
Source One Aircraft Repair H2/A5
Source One Spares H2/A5
South Alabama Aviation Advantage H3/B22b
South Carolina Department of Commerce H3/B3
South East England Development Agency (SEEDA) H1/B18
Southeast Alabama Gas District H3/B22b
Southeast Florida Regional Airport at St. Augustine H3/B20, H3/B21
Southern Aeroparts - AMETEK MRO H1/B5
Space Florida H3/B20, H3/B21
Space News International H2/B37
SPARC, ZAO H1/E11
Spatial Integrated Systems, Inc. (SIS) H3/B19
Specialised Polymer Engineering Ltd H1/A3
Specialist Electronics Services Ltd H4/F3
Specialist Technologies Aerospace Group (STAG) H1/A18
Specialist Technologies Ltd H1/A18
specTECH FRANCE H1/A18
specTECH USA (Sales) H1/A18
Spectrolab H2/B7
spectTECH USA (Logistics) H1/A18
SpeedNews H3/D5
Spin.Works H4/E3
Spirit AeroSystems ..... H3/A12, Chalet: C19 - 21
SPS Aerostructures Ltd. H4/F13
SPS Fastener Division H4/F13
SPS Technologies - Jenkintown H4/F13
SPS Technologies - Santa Ana H4/F13
SPX Precision Components H2/B16
SR Technics H4/D9
SREBOT Technologies H1/A15
SRPE Bazalt H1/E11
SSE - Sofiter System Engineering SpA H1/D16
ST Engineering ..... Chalet: A30
St. Joe Company, The H3/B20, H3/B21
Staco Systems H2/A3
Stahlwille Tools Limited H2/C24
STAR Dundee Limited H1/B19
StarragHeckert AG ..... H1/A16 & H1/A24
State Company Ukrspetsexport H2/C23a
State Corporation Russian Technologies ..... H1/D17, D22 & E11

State of Connecticut H2/B16
State of Georgia - USA ..... H2/B8, Chalet: A28
State of Illinois European Office H2/A2
State of New York H3/A10a
S-TEC Co., Ltd. ..... Chalet: C30
Stein Seal Company H1/B1
Stein Seal UK Ltd H1/B1
Stone Foundries H1/B20
Stop-choc Ltd H3/D9
STRAERO S.A. H3/B30
Strativer H3/D9
STRUCTIL H1/A15
STS Defence Ltd H1/B21
SUKHOI Aviation Holding Company ..... H1/E9, Chalet: B7 - 9
Sukhoi Civil Aircraft Company ..... H1/E9, Chalet: B7 - 9
Sulzer Eldim B.V. H3/C2
Sun Test Systems H3/C2
Sunaero H1/A15
SuperJet International ..... Chalet: B15 - 16
Supply Dynamics H4/D5
Supply Point Systems Limited H4/E17
Survival Equipment Services Ltd H4/FT16
Swedish Space Corporation H1/A25
Swift Aerospace H3/C20
Swissmem ..... H1/A16 & H1/A24
Symetrics Industries, Inc H3/B20, H3/B21

T & R Precision Engineering Ltd H1/D14
Tactair Fluid Controls Inc H2/B1
Tactical Missiles Corporation JSC H1/D17
TADA H4/E1
TAG Aeronautics Ltd ..... Chalet: C3
TAG Aircraft Interiors Ltd ..... Chalet: C3
Taiyo Kinzoku Industries Co., Ltd. ..... Chalet: C30
TAKE-OFF Magazine H1/E4
Talascend H1/B15
Tamaulipas H3/D16
TANIDA LTD. ..... Chalet: C30
Tap Maintenance & Engineering H4/E3
Target Aerospace Ltd H1/D10
Tata Consultancy Services Ltd (TCS) H1/B15
Taunton Aerospace Limited H1/B16
Taurus Solutions H1/B18
TCR International ..... H1/A13 - A14
TDC Corporation ..... Chalet: C30
TDM Technical Services H4/C18
Technical Airborne Components H4/F2
TechniGraphics, Inc. H2/B14
Techspace Aero ..... H1/A13 - A14
Tecno Meccanica Di Gianluca Magrini H4/E5
Tecnomeccanica Leini H1/D16
TECT ..... Chalet: C4 - 5
Tecvac Ultra Hard Coatings Ltd H4/G1
TEI - Tusas Engine Industries H3/C6
TEKEVER H4/E3
Telephonics Corporation ..... H4/E11, Chalet: B22
Telespazio ..... OE1 & OE2
Telex Communications - Bosch Security Systems H4/G17
Tennessee Valley Authority Alabama Region H3/B22b
Terma A/S H2/C26
TEST-FUCHS GmbH H4/E20

Texstars Inc H1/B15
Textron Defense Systems ..... Chalet: L3 - 7
Textron Systems H2/A16
Thales ..... Chalet: S1
Thales Alenia Space ..... OE1 & OE2
Think Tank Maths Limited H1/B15, H1/B19
Thompson Friction Welding Ltd H4/B10
ThruVision Systems H3/D24
ThyssenKrupp Aerospace H2/C25
ThyssenKrupp VDM GmbH H4/A16
Tianjin Free Trade Zone H2/C33
Tibeni Group H4/E6
Tiernay Metals Ltd H4/E2
Tijuana Economic Development Commission H3/D16
TIMCO H3/B19
Times Group H2/C6
TIMET UK Ltd H1/B21
Timken Company, The H2/B9
Titanium Industries UK Ltd H1/B7
TJ Brooks H4/F13
TMD Technologies Ltd H1/B15
TNO H3/C2
Today's Pilot H1/C1
Tods Aerospace H1/B16
Tokai Carbon Europe Ltd H1/C19
Torino Chamber of Commerce H1/D16
Torino Piemonte Aerospace H1/D16
Tower Tool Company Limited H1/B14
Towerfield Plating Ltd H4/A9
Toyo Koku Denshi Co., Ltd. ..... Chalet: C30
Trac Group Ltd H4/C16
TRAK Microwave Limited H1/B19
Transaero, Inc. H3/A7
Transtar Metals FR H4/E2
Transtar Metals Ltd H4/E2
Trelleborg Sealing Solutions Ltd ..... H4/C1, Chalet: B17
Tridan Engineering H1/B20
Trio-Tech Inc. H4/C18
Triple S Aviation H2/A20
Tritec Ltd H1/D10
Tritech Group Ltd H1/B17
Triumph Group Inc ..... H2/B22, Chalet: A15
Tsudakoma Corp ..... Chalet: C30
TTL ..... H1/A16 & H1/A24

TTTECH Computertechnik AG H3/A1
Tubiflex SpA H1/D16
Tupolev Jsc. H1/D15
Turbocam Europe Ltd H1/B18
Turbomak H3/D2
Turbomeca ..... H4/B12, Chalet: C6
Turbomecanica S.A. H3/B30
Turkish Aerospace Industries (TAI) H3/C4
Turner Aviation Limited H1/B19
Tuscaloosa County IDA H3/B22b
TVA Economic Development H3/B22b
TW Metals Ltd. H4/D5
TWI Limited H4/F4
Tyee Aircraft H4/F2

U.S. Army Product Manger Air Warrior H2/B33
U.S. Department of Defense H2/A17
UAVision - Engenharia de Sistemas Lda H4/E3
UAVS H3/D19d
UBIFRANCE - French Trade Commission H1/A15
UBM Aviation H1/B18
Uepro Lda H4/E3
UFC Aerospace Europe Ltd. H4/G14
UK Space Agency H3/SZC
UK Trade & Investment H1/B12
Ultra Electronics H1/C7
Ultra Electronics Advanced Tactical Systems H1/C7
Ultra Electronics AudioSoft H1/C7
Ultra Electronics Communication & Integrated Systems H1/C7
Ultra Electronics Controls H1/C7
Ultra Electronics Electrics H1/C7
Ultra Electronics Flightline Systems H1/C7
Ultra Electronics Precision Air Systems H1/C7
Ulyanovsk Region Russia H3/B28a
Umbra Cuscinetti S.p.A. H4/E5
Umbria Aerospace Companies H4/E5
UMI AERONAUTICA H4/E1
Unipart Eberspacher Exhaust Systems H1/D11
Unison H4/F12
United Engine Corporation, Managing Company H1/D17
United Kingdom Border Agency OE19
United Performance Metals H4/D5

United Technologies Corporation ..... Chalet: D14 - 16
Unitron, LP H4/G17
Universal Engineering H1/B16
Universidade da Beira Interior H4/E3
University of HertfordshireFutures Day, Panorama A/10
University of Liverpool, Virtual Engineering Centre H1/D11
University of Surrey H3/SZ10
UOP H3/A9a
US Army PEO Soldier H2/B33

Valley-Todeco H4/F2
Van Asbrouck Recruitment ..... H1/A13 - A14
Vector Aerospace Engine Services UK Ltd H1/B15
VEGA Consulting Services ..... OE1 & OE2
Verify Europe H1/C17
Viking Air Limited H4/C20a
Virtek Vision International H4/C18
Virtual Human Resources H1/B18
Vital Link Europe Ltd H1/B18
Vniiem (All-Russia Research Institute of Electromechanics with the Plant named after A.G. Iosifian) H1/E10
Voith Engineering Services Limited H1/B16
Voss Industries, Inc. H4/C10
Vulcanium Metals International H1/A2
VX Aerospace Corporation H3/B19

Walker AEC Ltd H1/B16
Wall Colmonoy H1/B17
Wallwork Heat Treatment Ltd H4/G1
Washington State Dept. of Commerce H2/B34
Waterjet Group, The H1/D11
Welsh Assembly Government H1/B17
West Middlesex Surface Treatments Ltd H4/A9
West of England Aerospace Forum H1/B16
Western Economic Diversification Canada H4/C19d
WheelTug plc H2/C3
Whitcraft Group H2/B16
Wildfire Information Systems Limited H1/D11
Wilsons Limited H3/D11
Winchester Consulting Limited H1/B18
Wipaire Inc. H2/A21
Wipro Limited H3/C16
Wolverhampton CIty H1/B14
Woodward H3/B13
World Aircraft Sales Magazine H2/C2
World Aviation Communications H2/C2

Xhibeo Limited H1/B18

Yamato Alloy Co., Ltd. ..... Chalet: C30
Yarde Metals Corporation H2/A26
Yu Engine R & D Co. Ltd H4/FT1
YURA SANSHO CO., LTD. (Representative of OWO) ..... Chalet: C30

Zeeko Ltd H1/B14
Zettlex Ltd. H4/D4
Zibrant H3/B25b
Zodiac Aerospace H1/A15
Zodiac Data Systems - Zodiac Aerospace H1/A15
ZOK International Group Ltd H4/B6

Farnborough isn't all about aeroplanes – in 2008 World Champion-to-be Lewis Hamilton demonstrated his McLaren F1 car. Aerospace and motor sport have much in common! KEY COLLECTION

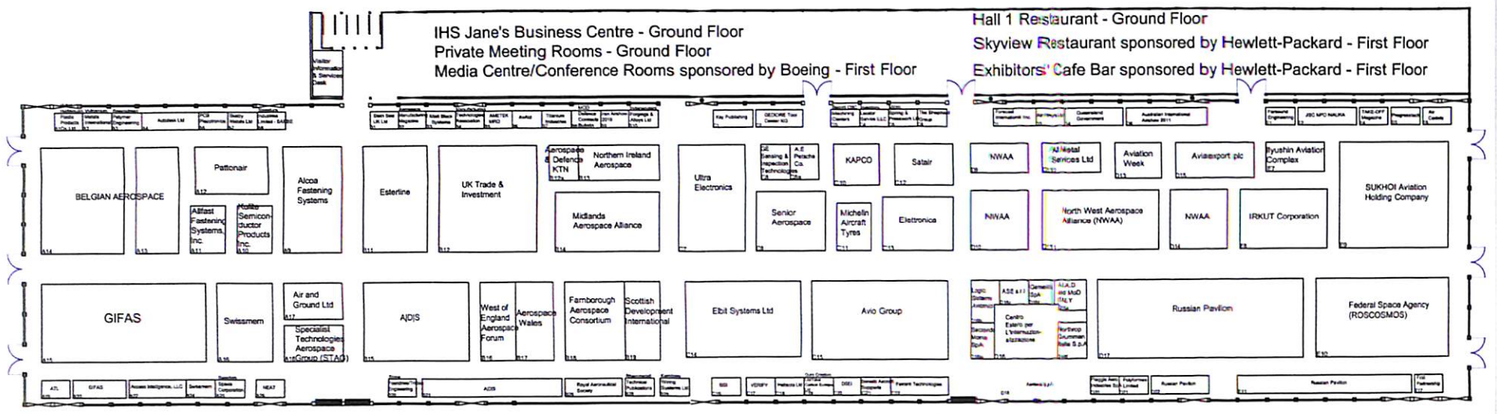
Exhibition Halls

Farnborough International Airshow welcomes hundreds of aerospace companies from around the globe to exhibit the latest products, technologies, innovations and services in the four main exhibition halls.

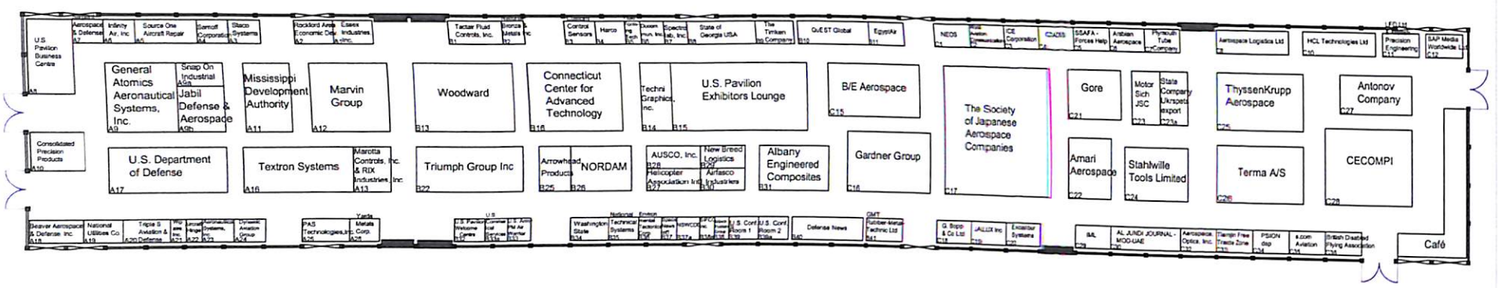
Whether it's widgets, grommets or gizmos, you're sure to find every aspect of 21st Century aviation represented. Take your time to browse the many displays and stands, most of which remain open during the public days once the business of the first four trade days has been done.

KEY COLLECTION

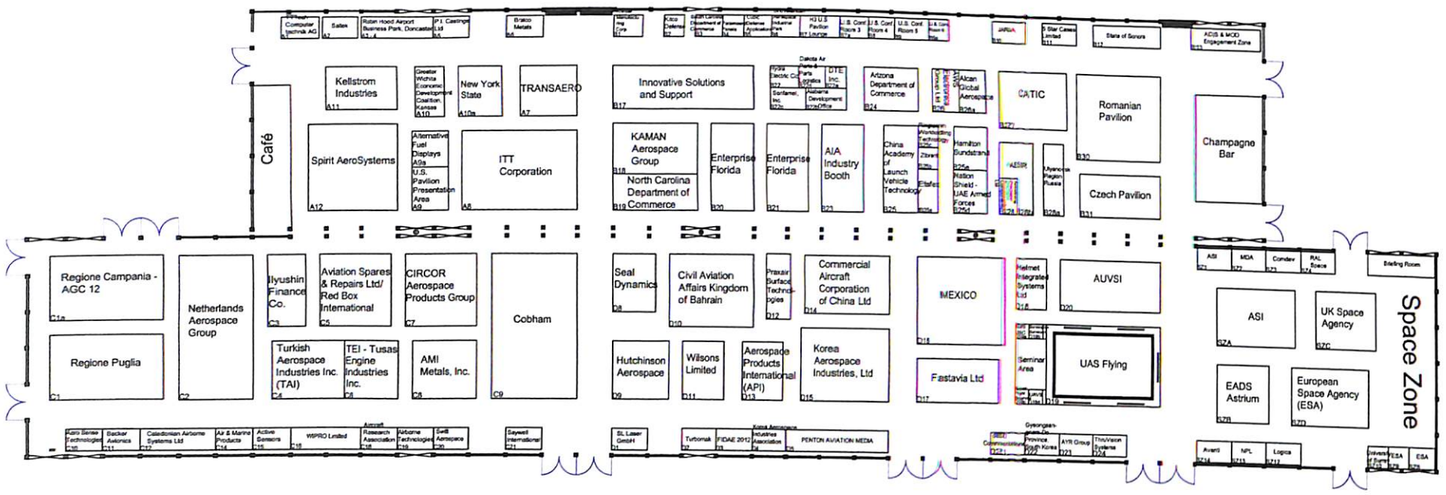
HALL 1



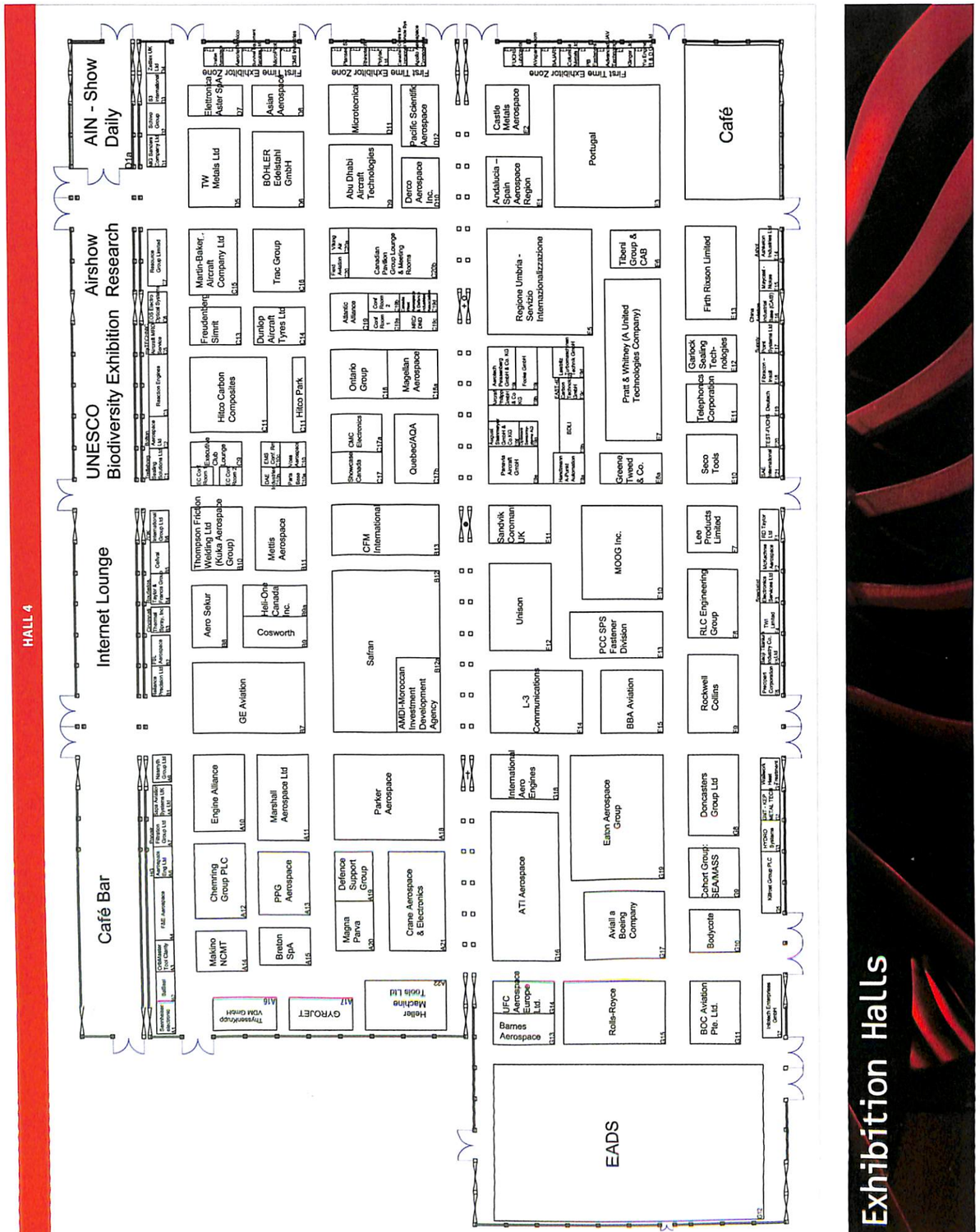
HALL 2



HALL 3



Exhibition Halls



LOOK NO FURTHER FOR YOUR PILOT TRAINING

So you want to be an airline pilot?

The right training background will ensure you are best placed to achieve that dream. CTC's approach is extremely specialist - we are all about training tomorrow's airline pilots today.

The very best training is essential – whether you're just getting round to thinking about where to train, or you've already decided – if it's not CTC – THINK AGAIN!

CTC Wings Cadets achieve some of the highest marks in the industry -

- ✈ 99.8% pass all 14 ATPL subjects at first attempt
- ✈ 93.4% average mark across all 14 subjects
- ✈ 93.5% CPL first series pass rate
- ✈ 97.4% IR first series pass rate
- ✈ 98.3% success rate through training

STOP PRESS: easyJet chooses CTC as preferred supplier of pilots for next 5 years
Over 200 pilots placed since January 2010 with easyJet and other partner airlines

Look no further for your pilot training
Apply to CTC Wings today

CTC WINGS - MAKE YOUR CAREER FLY

www.ctcwings.com

PURE BREITLING

*RRP. Subject to change without notice.

POWERFUL. UNIQUE. PURE BREITLING

The Chronospace £ 3580*

For your nearest stockist in Great Britain and Ireland telephone 020 7637 5167

WWW.BREITLING.COM

BREITLING
1884

INSTRUMENTS FOR PROFESSIONALS™